VOLUME 6 APRIL 4, 1900 NUMBER 1



# The Horseless Age

EVERY WEDNESDAY

In the Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

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LOOK FOR THE ACETYLENE MOTOR NUMBER.

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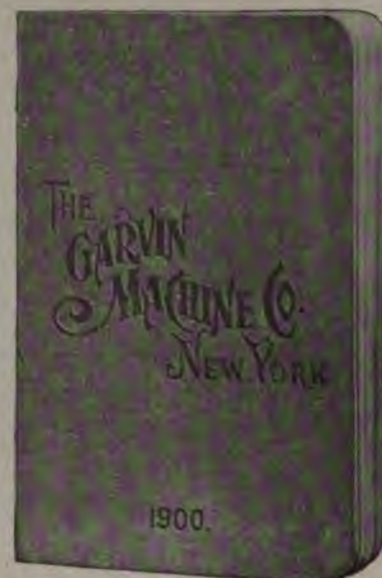


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VOL. VI. NEW YORK, APRIL 4, 1900. No. 1.

## THE HORSELESS AGE.

**E. P. INGERSOLL, Editor and Proprietor.**

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## The Evolution of the Industry.

The inventor, the mechanic and the engineer have each his role to play in the development of a new industry, and they come upon the stage almost necessarily in the sequence named. It is the inventor's part to blaze the way. His is usually the brain that first conceives the possibilities of the industry yet unborn, and his sanguine temperament, even his unscientific audacity, fit him for the repeated and often bootless experimenting, the unwearied pursuit of the elusive but vital principle, and the patient development through many failures of the completed invention. But it is one thing to invent and even to demonstrate the practicability of the invention, and another thing to embody that invention in economical working form. Fortunate is the inventor if he possesses likewise the instinct of the true mechanic! For if he does not he will be well advised, having made good his right to the child of his brain, to turn its further development over to better-trained hands than his and to enjoy in peace the fruits of his share in the general work of progress. There are far too many would-be inventors who, through rashness and mechanical ignorance, are wrecked before they make good their claim to the title; but we are glad to believe that as America is pre-eminently a nation of mechanics, so it is America's peculiar distinction both that her inventors are most of them mechanically gifted and that her mechanics are potentially, if not actually, inventors. We doubt if the same keen mechanical sense and the same quickness in searching for and seizing on improvements is the common possession of mechanics in any other nation of the world, while no boy of an inventive turn of mind is here without the education of the village blacksmith and repair shop.

These two, the inventor and the mechanic, have done and are doing their work for the motor vehicle, the former seeking new devices to meet the new demands, and the latter applying his practical experience and judgment in reducing them to effective form. Much still remains for them to do and much will assuredly be done; but revolutionary inventions, while they may yet come, are no longer necessary to make the motor vehicle a success. The inventor's most difficult work has been performed. The mechanic, coming later on the field, has more still before him. There is no lack of ingenuity in motor vehicles; indeed, it is on the side of excessive ingenuity that they are most apt to err; and, after remedying the weak points revealed by test, the mechanic's next task is in the direction of simplifying, finding short cuts to a given end, and making an hour's work do what two hours' did before.

It is here that the engineer appears—the man of trained mind and scientific knowledge, the analyst of forces, the organizer of shops and equipment. The inventor and the shop mechanic are honored and indispensable, and the engineer, preferring to deal with known quantities, has no wish to invade their sphere. But the inventor is often too unskilled to deduce from his experiments all that they are capable of teaching, and

the machinist is apt to be handier at running a lathe than at organizing production. The engineer, therefore, derives from the results of his predecessors' work the principles governing the future. He can calculate the power of the motors and the proportions of rods, shafts and gears; he knows how to secure stiffness without increase of weight, and he can predict in advance the effect of a given change. This is the engineer's work as a designer. On the commercial side he will join hands with the mechanic—the foreman of the machine shop, the pattern-maker, blacksmith and molder—and together they will decide as to the economy of alternative designs and will unite in recommending the specific tools and equipment for producing the work to the best advantage. Not seldom, in our own country especially, the engineer has risen from the ranks, and therefore combines the higher logical faculties called for in his position with the shop training of the practical man.

When the motor vehicle industry enlists the services of the engineer, it may no longer be regarded as ephemeral, but as having an assured future and already a degree of stability. It is for this reason that the article on another page, describing the Thornycroft Steam Wagon Co.'s works, is worthy of the attention of every one seriously engaged in automobile production. In themselves these shops cannot be called remarkable, being simply an embodiment of the most enlightened modern ideas as to shop architecture and equipment. What is noteworthy about them is that they stand for the definite entry into the motor vehicle field of one of the most celebrated of British engineers. So long as the steam lorry and traction engine were in the experimental stage no such factory was possible, for it implies established design, the duplication of parts and systematic direction of the efforts of many.

We have started later on this side, but the leaders are using every effort to perfect their product to the degree where organized production is possible, and already with some measure of success. From now on not only the inventing but the manufacture of motor vehicles is destined to claim attention, and we believe that The Horseless Age can do the industry no better service than by keeping builders informed as fully as it can of the progress making in this line.

## An Example of Our Policy.

The article on "Two-Cycle vs. Four-Cycle Motors" in our issue of March 21 was written in response to the requests of a number of our subscribers for information as to the comparative merits of the former type of motor. Its author, in complying with these requests, endeavored to state the case impartially, and his summing up was in accordance with his experience and observation. We are not surprised to learn that some of our readers do not agree with the conclusions there expressed, and to all such we would say that the single object of The Horseless Age is to give the best information obtainable on all subjects connected with motor and vehicle design, and that our columns are freely open to all who can add to or correct the statements we publish. Our aim is the good of the industry, and we welcome contributions from every source.

## Gas Engine Valves, I.

By Herbert L. Towle.

Confining this paper to valves opening directly into the cylinder or combustion spaces, the following types have been used or attempted: Reciprocating slide valves, piston, rotary and poppet or mushroom valves. The earliest non-compressing gas engines simply borrowed the slide valve from the steam engine; but these early motors converted so little caloric energy into work, and wasted so much in heating the engine and jacket water, as would have taxed the endurance of even the best of valves. M. Aimé Witz says of the Lenoir engine, which created such a furore in France before its faults became known, that, "Claimed to consume but 30 ft. of gas per horse-power per hour, it devoured 100, if not more. It used more water than a non-condensing steam engine of the same power; and unless an attendant, armed with an oil can, stood over it and drenched it with whole quarts of oil, it suspended action and would not go."

The early Otto compression engines used a slide valve for admission and exhaust, and ignited the charge by a flame carried in a pocket in the valve. The obstacles to successful working were here much less formidable, and many of these engines are in use to-day. With the application of the poppet valve, however, there was a general abandonment of the slide valve; and so far as the writer is aware, it is not used to-day by any builder. The objections to the slide valve are, first, that the high temperature of the cylinder head makes it difficult to maintain proper lubrication, and, second, that the valve requires attention and occasional scraping to keep it tight. In general, the slide valve is more cumbrous, more expensive, and more troublesome, as a means to the given end, than the poppet valve, and has therefore been pushed aside on economic grounds.

The only real objection to the poppet valve is the noise it makes, and this has stimulated some inventors to experiment with piston and rotary disk valves. These do not appear to have been attended with any marked success, however; although one concern in this country builds all its engines with a continuously-rotating disk valve inside the cylinder head, and one or two builders of two-cycle engines transfer the fresh charge to the cylinder through a piston valve in the cylinder head. It would appear that neither type of valve is mechanically impracticable, and the real question is whether the advantages of its use outweigh the disadvantages. The rotary

valve has not found much favor in steam engine practice, because it tends to wear faster near the circumference than near the center. The piston valve in the above instance is obviously much more easily kept in order than it would be if the exhaust gases were discharged through it, and its success there could hardly be taken as proving anything further. It should be remembered that the conditions imposed by the high temperatures in the gas engine are far more onerous than those obtaining in the steam engine. Between the heat within and the water without, the molecular strains induced tend to relieve themselves by both temporary and progressive warping of the metal; and the life of so nicely fitting a part as a piston valve would be apt to be a short one.

The poppet valve requires no lubrication: if the disk be made of cast iron or nickel alloy its surface will not oxidize: it is less sensitive to warping of its seat than either the rotary or piston valve, and it is more easily made tight. If quiet running is an object, the inlet valve, which makes some clatter if opened by suction, can be operated by a cam; and with light valves and properly designed cams the noise should then be trifling. Taking it altogether, despite the mechanism required to operate the poppet valve, the severe simplicity of the valve itself renders it better qualified for its difficult duty than any other type; and future improvements are probably to be looked for in the details of its design rather than in the appearance of a substitute.

The writer lately received a query as to the probable fitness of the ball valve for gas engine work. These ball valves are used chiefly in small pumps for water and liquids, and consist of a simple ball confined in a cage so that it is lifted by suction or pressure and drops back of its own weight. The writer has never heard of their being used on gas engines, and in his opinion they would be quite unsuitable for such service. A little leakage does no great harm in a water pump, and even that may be stopped by using a leather or rubber seat; but in a gas engine nothing but absolute tightness and a metal-to-metal seat can be considered; and such tightness can be obtained only by grinding, or by hand scraping to a surface plate in the case of a slide valve. To roll a bicycle ball to an approximately spherical form is not difficult, but it is not probable that any concern at present doing business would undertake to produce spheres from one inch in diameter up, within a deformation limit of, say, .0005 of an inch; and it is equally unlikely that such spheres would retain their rotundity more than a very short time. It is well known that a hard deposit of unburned carbon gathers on all the inner surfaces of the combustion space, except the rubbing surfaces kept clean by the piston, etc.; and this deposit would form on the ball face likewise, and when the ball turned slightly it would get under the seat and cause a leak. This might be minimized by making the seat very narrow, so that the valve would be in a measure self-grinding; but the ball would then overheat owing to lack of contact with the cooling surface.

A ball valve might conceivably be used in the transfer passage of a two-cycle engine, provided the cylinder transfer port were opposite the exhaust port, and therefore covered by the piston during combustion; but even there it would have nothing to recommend it, and it would have the disadvantages of being noisy and of being sluggish in action owing to its weight and inertia. It would probably be altogether useless at high speeds.

## The Hinrichs Igniter.

The Hinrichs Novelty Co., 1112 West Washington St., Indianapolis, Ind., are bringing their ignition dynamo to the attention of the trade. It has self-lubricating bearings. The armature commutator and brushes are all entirely inclosed and are therefore dust and moisture proof. The material and workmanship are the best obtainable. The machine is so constructed as to give off the same amount of voltage as six sets of new batteries, but not the amount of amperage, as it is the ampere that destroys the electrodes in the engine.

This igniter may be connected with belt or friction direct to the engine and start without the use of batteries. It has self-adjusting brushes, easy to get at, impossible to get in wrong. The dimensions are 6 in. high, 8 in. long, 5½ in. wide; speed, 1,500 to 2,000; pulley or ¾ flat or 5-16 round belt, 1¼ in. diameter.

## Motor Tricycle Race.

Arrangements have been made for a motor tricycle race to take place at Boston, about May 1st, between Kenneth A. Skinner, United States agent for the De Dion motors, and Albert Champion, an expert French racer, who will ride an "Orient" tricycle, propelled by an Aster motor. The distance will probably be 100 miles, and the motors employed will be limited to 2¼-h.p. in order that the speed attained may not be too great.

F. R. Wood & Son, of West 19th St., have been granted patents on a special gear for motor vehicles and a steam engine, which is said to be specially adapted to vehicles. The engine above referred to burns coal, one cubic foot of which is claimed to be capable of developing 7 h.p. They will henceforth build steam as well as electric delivery wagons.

WINTON RACER FOR GORDON-BENNETT CUP.

# Evolution of the Motor Vehicle as Shown by Patents.

PART III.—THE TRANSMISSION GEAR.

By Leonard Huntress Dyer.

The field of the transmission gear does not offer such an opening for ingenious work as that of the differential and the steering gear. The confronting obstacles having been overcome by these latter, would easily allow of an operative structure being made by the simple addition of a prime mover and the necessary connecting media.

In the early devices steam was almost exclusively used, although internal combustion or explosion engines are disclosed in several very old patents. It is not until a comparatively recent date that electricity was at all used. Steam was known to be practical; the form of transmission gear could be very simple.

Some patents of the past century and the beginning of the present one illustrate, however, elaborate arrangements to permit the gradual starting of the vehicle and to allow changes of speed irrespective of that of the engine.

The simplest idea would seem to be to couple the engine direct to the drivers, one or two in number, either by inside or outside cranks. This and the usual connecting rods arrangement was early abandoned in favor of the high speed engine connected to the wheels by a reducing system of spur gears, chains, longitudinal shafts with bevel or worm gears, or belts.

The more primitive devices show the engine mounted directly upon the supporting axle or upon a rigid frame attached thereto. Later patents illustrate engines mounted upon spring-supported bodies. The latter arrangement requires that the gear trains possess some degree of flexibility. When longitudinal bevel gears are here employed universal joints are always present in the former.

Quite an elaborate arrangement of oscillating members engaging by means of clutches to the wheels was early originated. Such devices allowed of a variable stroke being given to the clutch and the speed controlled at will.

A large field is covered by combined steering and driving wheels. This seems to have been very attractive work for the inventor. Vehicles are shown in which a single wheel acts commonly as driver and steerer, as well as carriages in which two, three or four wheels act as drivers and as steerers as well.

The single steering driving wheel is readily operated by being directly connected to the engine, the latter being mounted upon the wheel support and turning with the same on the king post.

Where two wheels are to be simultaneously driven and steered, the conditions are more complicated. Several ways are shown common to different patents. In the first arrangement the axle may be rotated within fixed boxes, the wheels being carried upon gimbal joints at the extremities of the axle, and provided with suitable steering devices. The second shows an axle pivoted upon and turning through a bearing on the king post, and rotated by central gears, which connect to the axle either by a gimbal joint or by means of a spherical or globe gear, carried by the axle and engaging with a concave gear fixed on the frame and driven by the engine. A modification consists in mounting the wheels upon stubs and connecting their axles to the engine by globe and concave gears. A second modification employs a longitudinal shaft, driving the axle by a system of bevel gears. The shaft is provided with the necessary telescope section and universal joints required in practice.

A totally different arrangement consists in driving the axle from a vertical shaft, journaled within the king post and connected to the axle by bevel gears. This is elaborated in some instances by interposing telescoping sections and universal joints within the vertical shaft, to allow the body to vibrate and sway upon its spring independently of the connecting media.

Among particular patents, about the most primitive transmission is that shown in the American patent to B. Landon, Feb. 22, 1817, which shows a single driving wheel with direct crank connections to the engine. A heavy fly wheel is connected by multiplying gear to the driving wheel and turns at a high rate of speed. This wheel also serves as a means of storing up energy.

An English patent, granted to William Bray, Dec. 31, 1856, No. 3,102, shows a wheel driven by a pinion gearing with an internal spur wheel thereon.

An American patent to G. W. Barnett, No. 45,130, Nov. 22, 1864, shows a single driver. The engine shaft therefor is mounted concentrically therein, the wheel turning upon a sleeve. Spur gears connect the engine shaft to a countershaft and the countershaft to the driving wheel and serve to increase the power of the engine, with a corresponding decrease in speed.

The patent of F. Alger, No. 115,802, June 13, 1871, is introduced as showing direct connecting rod couplings to the rear axle with inside cranks.

A modification is shown in J. K. Fisher's patent, No. 1,987, of Aug. 6, 1861, wherein direct outside crank connection to two driving wheels is employed. The engine is on a rigid frame.

Among patents which show the engine on the axle with rigid connection are those of J. A. Sabin, No. 104,888, June 28, 1870, which drives by internal gears on each hub, and the English patent of Robert Fourness and James Ashworth, Nov. 6, 1788, No. 1,674, wherein is shown a connecting rod from each of the piston rods connected to a stud geared to a wheel on the axle of the driving wheels, one of which is fast thereon and the other loose to negotiate curves.

A rather complete arrangement is shown in the English patent to Joseph Reynolds, Jan. 9, 1816, No. 3,973. In this patent motion is imparted to the wheels from the crank shaft through sets of relatively different sized gearing on a countershaft, which according to the desired speed is brought into activity by crabs or clutches.

Another English patent is that of Patrick Kelly, dated Nov. 29, 1853, and numbered 2,775. The steam engine gives motion to a transverse crank shaft carrying two toothed pinions, which engage with a spur wheel fixed on the main axle, thereby giving motion through clutches to the two driving wheels.

Rather a complete and operative appearing device is described in the American patent to G. W. N. Yost, numbered 15,050, of June 3, 1856. A combination of external and internal gears is used. The great reduction from the engine is made to a countershaft by several sets of spur gears, from the countershaft to the wheels by pinions and internal gears.

A very similar arrangement is illustrated in the English patent to Collinson Hall and Thomas Charlton, of May 11, 1857, No. 1,328. In this patent the driving wheels of the vehicle have rings of spur teeth upon them, with which pinions gear themselves, driven by suitable gearing from the

crank shaft. Either or both wheels may be thrown into or out of gear by clutches as desired, when turning curves or running down grade.

The United States patent of R. H. Long, No. 29,911, Jan. 24, 1860, shows two driving wheels keyed to the extremity of the axle, in the center of which is a spur gear which engages with a pinion on the engine shaft. Two cranks are shown.

A modification is that of I. A. Sabin, No. 104,888, June 28, 1870. In this patent the driving wheels are turned by means of external spur gears.

Junius Poitevent, a subsequent inventor, shows in his American patent, No. 230,052, July 13, 1880, two independent engines, which drive the main wheels by trains of spur gears.

In the English patent of John Upton, Nov. 4, 1837, No. 7,458, the hind wheels are bolted to two short cylinders, which turn freely on the hind axle of the carriage. On the inner end of each short cylinder there is a cog wheel, which gears into a pinion on the axis of the rotary engine, and thus motion is given to the hind wheels.

J. Robingson, in an American patent, No. 15,820, Sept. 30, 1856, shows means for driving the countershaft by a chain, and the wheels therefrom by internal gears for low speed and external spur gears for high speed.

T. Blanchard, Dec. 28, 1825, shows a bevel wheel secured to the face of the driving wheel engaged with a pinion mounted upon a longitudinal driving shaft.

The patent to G. T. Ellis, No. 161,217, March 23, 1875, is much the same. The driving wheels are keyed upon a revolvable axle which carries a bevel gear. A horizontal engine shaft passes over the driving shaft and carries two pinions, either of which may be caused to engage with the bevel gear to propel the vehicle in either direction. The engine shaft passing above the driving shaft would throw a straight toothed gear out of working relations to the crown wheel or bevel gear, and accordingly a bevel pinion with inclined or twisted teeth which, although working in a plane out of line with the center of the crown wheel, meshes perfectly with the cog teeth of the latter. This is illustrated in Fig. 1, which shows the connection between the horizontal longitudinal shaft and the driving axle. The shaft a passes over the center of the axle b. The bevel pinion c engages with the gear d. The teeth of the former are inclined or twisted as shown.

Transmission by means of endless chains is shown in the English patent to Pierre Celestin Barrat, Nov. 25, 1847, No. 11,977. The forward movement is effected by an arrangement of different sized spur gear wheels, which may be thrown in or out of gear as required. The traveling wheels are driven by chains running over chain wheels to their axles. Jockey pulleys are arranged so that they can be forced down upon the chains or raised from them to allow the chains to run loose.

Another English patent, viz., of George Callaway and Robert Alle Purkis, of Nov. 24, 1849, No. 12,860, shows an arrangement of chain and spur gearing which allows of two speeds.

The English patent of William Henry James, Aug. 15, 1832, No. 6,297, is interesting. Three chain wheels are keyed on the crank shaft of the engine. These communicate motion to three similar wheels on the second shaft. The chain wheels being of different diameters, by clutching one or other of the wheels to their shaft, different speeds may be given to the driving wheels, which are worked by chain wheels on the second shaft passing over pulleys on the axle of the driving wheel. The clutches are applied by the driver's foot.

The American patent of R. H. Long, No. 26,911, Jan. 24,

Fig. 1

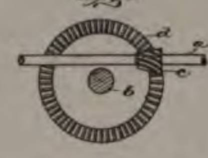


Fig. 4

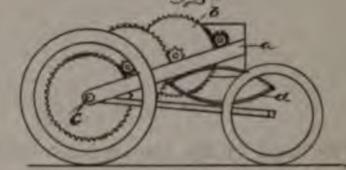


Fig. 2

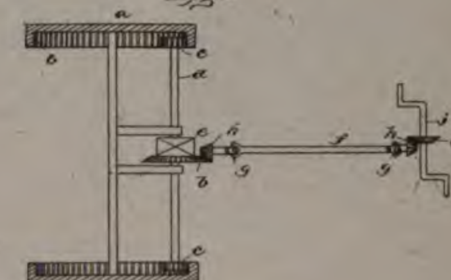
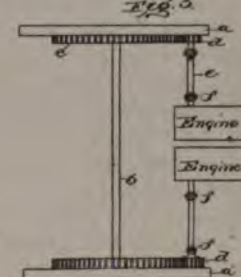


Fig. 3




1860, shows the two driving wheels keyed on the extremities of the driving axle, in the center of which is a sprocket wheel. The engine shaft carries a sprocket pinion which is connected to the sprocket wheel by an endless chain.

Benhard Yoch's American patent, No. 177,052, May 2, 1876, illustrates a chain and gear for propulsion. The engine is rigidly mounted on the axle.

The United States Patent Office granted a patent to T. Griffen, No. 31,595, March 5, 1861. In this patent the driven axle is shown as provided with a gear engaging with and actuated by a worm carried upon a vertical shaft, the upper extremity of which is provided with a bevel gear. This gear is rotated by engaging with a bevel pinion carried upon a horizontal engine shaft.

Among miscellaneous driving media the English patent to Joseph Büttess Bacon (a communication), March 11, 1835, No. 6,785, illustrates the following: The motion of the engine shaft is communicated by means of a train of spur and friction gearing to the driving wheel. The last wheel of the train is a friction pulley, which works against the rim of the driving wheel. Certain of the friction wheels are mounted on a lever arm, by means of which they can be brought into closer or less contact with the wheels they drive, and thus change the speed of the vehicle.

Some patents show means wherein the reciprocating motion of the piston is transformed into rotary motion by racks or pawls and ratchets. The simplest is illustrated in the English patent to William Lester, Sept. 17, 1814, No. 3,841, showing the engine as mounted on a wheeled frame, the wheels of which it drives by means of a double rack, engaging with a pinion on the axle of the driving wheel.

An elaborate device is illustrated in the American patent of T. W. Hazen, No. 113,767, April 18, 1871. In this patent the driven shaft carries a ratchet wheel. The piston rod of the engine carries two connecting rods, the outer extremity of each being provided with a pawl. One connecting rod rests upon the upper face of the ratchet wheel and the other is pressed against the lower face of the wheel by means of a spring. The connecting rods reciprocating, first one pawl and then the other will engage with the teeth of the ratchet wheel, rotating it constantly in the same direction.

A patent of almost even date, to N. B. Baldwin, No. 120,846, Nov. 14, 1871, shows two ratchet wheels keyed upon a driven axle with vertical arms carrying pawls journaled upon the axle adjacent to the ratchet wheels. The pawls engage with the teeth of the latter. The vertical arms are reciprocated by being connected at their upper extremities to the piston rods of the two engines. A link connects the two rods and causes them to move in rhythmical alternation.

This practically finishes the history of the rigid connections. They must have possessed practical objections, for at an early date inventors were trying to avoid this form by placing the engine above the springs, although this construction was considerably more complicated. An interesting patent is that of L. F. Hake, No. 62,264, Feb. 19, 1867. The driving wheels were rotated by means of a longitudinal shaft and bevel pinions and bevel gears. The engine is mounted crosswise upon a frame, which is supported upon springs. Universal joints are arranged in the longitudinal shaft to allow for vibrations and oscillations.

A somewhat later American patent shows an improvement. This patent is that of C. M. Miller, No. 221,900, Nov. 10, 1879. The two driving wheels are separately journalled upon the shaft. They carry internal gears; the countershaft carries plane gears. The engine shaft is parallel, mounted upon springs and carries a bevel gear. The two are connected by a longitudinal shaft with bevel pinions at its extremities and universal joints in its center. This construction may be more clear from an examination of the drawings. Fig. 2 shows a top view of the driving connections. The driving wheels a a turn loosely and independently upon their supporting axle. Internal gears b b are formed upon the wheels adjacent to the tires and engage with spur pinions c c, carried upon the countershaft d. A differential, e, and a bevel gear, d, are arranged adjacent to the center of the latter. The longitudinal shaft f is provided with the universal or knuckle joints g g and the pinion h h. The engine shaft i carries a gear, j, which engages with the appropriate pinion h. The engine shaft and its operating machinery are carried upon springs, which are not shown.

An almost contemporaneous American patent shows a slight modification. This patent was granted to R. Creuzbaur, No. 173,164, Feb. 8, 1876. The drawings illustrate two engines for driving the two driving wheels independently. The driving wheels carry spur gears, the engine shafts carry spur pinions. The two engage. The engine is supported upon springs. Universal joints are arranged upon the engine shaft. The drawings make the construction clear. Fig. 3 is a top view of the driving gear. The wheels a a are independently journaled upon the axle b. Each wheel a carries a gear, c, which engages with and is rotated by a pinion, d. The latter are turned by independent engines, carried by the spring-supported body, and each connects to a pinion by a short length of shaft, e, provided with universal joints, f.

A pioneer American patent, which may be said to anticipate the present mode of hinging electric motors upon cars and motor vehicles, is that of C. U. Hermance, No. 116,444, Feb. 7, 1871. Reference being had to the drawings: Fig. 4 is a side view of the complete vehicle. The propelling engine, or motor, a is supported upon a frame, b, pivoted to the driving axle c and supported at its free end by the springs d. A train of gears, e, transmits motion to the axle. It will be seen that the engine and frame can oscillate about its pivot point at a constant distance therefrom without affecting the operation of the gear train.

Another exceedingly ingenious American inventor, W. H. Milliken, obtained a patent, No. 163,681, on May 25, 1875. The driving axles are formed with universal joints so as to be flexible. The wheels are connected to the body by springs; the connection between the engine and the axle is entirely without elasticity. This patent will be described in greater detail further along.

Flexible driving media are described in the English patent to John Hippisley, May 19, 1853, No. 1,240. Bands from the engine shaft drive pulleys on axles below the boiler and these by spur gearing drive a pair of bearing wheels supporting the front of the engine. The driving band is of such a length that, except when it is lightened by a lever and pulley, the motion of the fly wheel pulley is not communicated to the pinion wheel and its pulleys.

An exceedingly interesting English patent was granted to the famous John Watt, April 28, 1784, No. 1,434, for a traction engine transmission by racks and sectors acting on ratchet wheels on the axles. Two or more loose wheels of different diameters are placed to be locked on the axle and impart extra power for bad roads or steep ascents. No illustration of this feature is made and it is impossible to understand the exact arrangement of the device.

An American patent to G. N. Tibbles, No. 96,636, Nov. 9, 1869, shows pawl and ratchet with variable throw lever. The engine is mounted upon springs. By varying the throw of the lever the speed may be changed.

Alpheus B. Stickney, in his patent of June 13, 1876, No. 178,809, drives the wheels as follows: The axles are mounted in supplementary carriages which slide back and forth on the carriage frame. Pitmans reciprocate the supplementary carriages. Pawls are provided to keep the wheels from revolving in the reverse direction.

The three following English patents are of interest as showing modified forms of flexible gear trains, or transmission media. The first, to John, William, George and Ruben Heaton, Oct. 6, 1830, No. 6,006, is as follows: Motion is communicated from the crank shaft by means of spur gearing to a second shaft, and from this by connecting rods to a third shaft having a pinion thereon gearing with a spur wheel on the driving shaft. The second shaft is fitted with over-riding clutches for turning curves. The object of this arrangement is to allow the engines and boilers to be mounted on springs, while the motion is communicated to the parts which are not mounted on springs. The third shaft, above mentioned, is mounted on a frame carried by the axle of the driving wheels.

The second to William Church, March 16, 1835, No. 6,791, describes the crank shaft as communicating a to and fro motion to cranks on a second shaft, and other cranks or levers on this shaft are joined by connecting rods to smaller cranks on the axle of the driving wheel, which thus receives a rotary motion.

Sir James Caleb Anderson obtained a British patent on June 29, 1846, No. 11,273. In this motor vehicle a pair of oscillating steam cylinders actuate a crank on the power wheel axle, whence from each end respectively lever arms transmit the power by means of connecting rods and crank pins on the driving wheels.

(To be continued.)

## Suggestions on Ignition.

By Reginald P. Wales.

It is always best for the motorist using gasoline as the motive power to arm himself with a battery gauge and a common electric bell, the former for testing the combined and individual strength of the cells, for it frequently happens that one cell will, through local action, become partially or wholly exhausted, while the rest may retain their normal strength. If this takes place the gauge will locate the cell and show its efficiency in working units; and if such a cell is found below par it may be cut out of the circuit until it can be recharged, thus cutting out the point of resistance. This instrument will often pay for itself in a remarkably short space of time, for many motorists, failing to get a spark at the points sufficient to ignite the charge, take it for granted that the whole series of cells is exhausted and needs recharging, whereas it is only one cell that is the direct cause of the trouble. If the batteries have been recently charged and are in proper working order it is well to make a test of the whole series and also of an individual cell, remembering the figures in both cases; then, in the course of time, if the engine works badly, a second test will prove whether they are supplying their usual amount of current; but should it be found that they have fallen below the figures previously taken, the next step is to make individual tests of the different cells.

It frequently happens when going over a rough stretch of road or passing over some obstruction that the sudden jar causes the rod which supports the zinc element in the batteries to part, making a complete opening in the circuit and cutting off the supply of electricity to the sparking points at once. Though this may not happen frequently, it is well to provide oneself for the emergency by putting in the tool box a bell, which will be found indispensable in a case of this kind. The first time my machine suddenly stopped it required two hours to start it again, about half of this time being consumed in locating the broken cell, as I had neglected to provide myself with the above-mentioned article, while the balance of the time was used in looking elsewhere for the seat of the trouble. With many classes of batteries the output is so small that no perceptible spark is seen when the positive and negative wires are brought into contact with each other. If there is a current in such cells it may easily be ascertained by bringing the wires to the tongue, whereupon a metallic taste will be noticed. However, this is not a very satisfactory way to test batteries, for by this method it is impossible to know whether the cells are giving their normal supply of current. True, the gauge may be used instead of the bell, but the latter requires less time, for it is not necessary to connect on wires with each cell, the binding posts of the bell being easily placed in contact with those of the battery.

In using a cable wire from the induction coil to the sparking points a strand will often come in contact with the opposite pole at the point of connection with the igniter, causing a short circuit and stopping the engine. How many motorists have spent hours in trying to start their machines, but failed to look at this little point, where originated all the trouble! On my machine I removed the cable wire and put on a No. 14 solid, but was constantly annoyed by its breaking at the cylinder owing to the rocking motion of the sparking rod, and so was forced to change back again to the cable wire. Before I put the latter on, however, I had the ends soldered, thus making a clean connection and keeping the stray strands from coming in contact.

By transposing the wires at the batteries, connecting the negative wire to the positive pole and vice versa, it likewise causes a change to take place at the sparking points; and when the engine refuses to work, simply changing the poles will, in many instances, be found sufficient to start it again. I have tried this scheme four or five times and with good success.

[It is not clear to us why the transposition mentioned in the last paragraph should improve the spark. Have any of our readers had a similar experience? We should expect to find the change due to improved contact at the binding posts.—Ed.]

## Vaporizers.

By L. Berger.

As a contribution to the studies of carbureters and vaporizers which have lately appeared in The Horseless Age, and in order to present a complete treatise on the question, we shall speak of a vaporizer widely used in Europe—the Longuemare vaporizer. This vaporizer has been well worked out in both construction and design and it certainly presents some very good features. It is composed of three principal parts:

1. The constant level with float.
2. The vaporizer.
3. The mixing chamber.

Fig 1

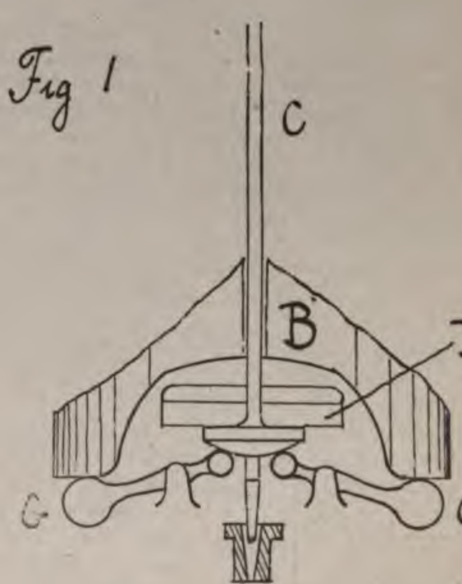
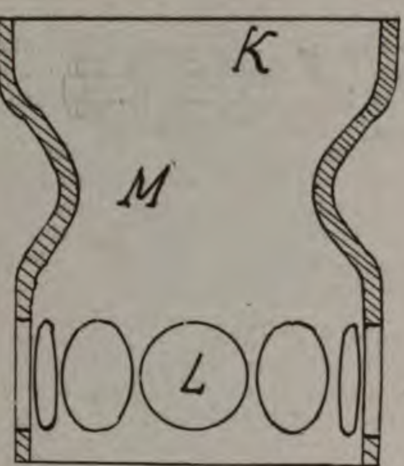


Fig 2

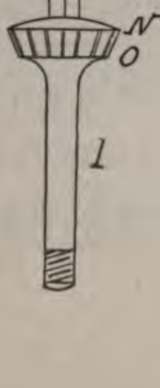



The constant level tank (see Fig. 4) is formed by a cylindrical bronze box, A, containing a float, B, made of sheet brass and soldered, which slides freely along the stem of the needle valve C. The needle C (see Fig. 1) is made of an alloy of nickel not affected by the gasoline, and is of triangular section; it is led above into a screwed cap on the cover of A and supports below a balancing weight, D. The stem terminates in a blunted needle point, which closes the orifice E of the gasoline pipe, and rests on a surface of soft brass or copper.

Above the needle cone is shown in Fig. 1 an enlargement with rounded under surface, against which bear freely the ends of the two balanced levers G, by means of which the needle is raised by the downward movement of the float. This feature of movement of the float regulation is far superior to that of supplying the gasoline from above, which was the first method employed by Longuemare and other builders. It gives a perfect movement of the apparatus with a minimum of friction on the small diameter of the needle and is sensitive, being well balanced. The lower part of the apparatus, by which the gasoline is supplied, has joints similar to ordinary pipe unions and is provided with cleaning-out hole and screwed cap.

The cover of the box A is an easy fit and is fastened by screws. It is provided with a small spring plunger, F, shown in Fig. 4, designed to shake the float if it sticks, and also to get up some drops of gasoline into the vaporizer for the

Fig 3




start. The levers G and plunger F are likewise made of nickel alloy.

The vaporizer, shown in Figs. 2, 3 and 4, contains a central tube H, supplying the gasoline, inside of which is the sprayer I. Inclosing H is a sort of tuyere which forces the air entering by the circular apertures L to its constricted portion M on the same level as N (Fig. 1). This tuyere is shown in Fig. 2. The brass piece I, Fig. 3, is held by its lower threaded end and can be unscrewed by a wrench applied to its squared upper end. The head N O, which is coned about 60 deg., closes the upper end of H, and has 8, 10 or 12 grooves, narrow but deep, by which the gasoline is sprayed to the outer circumference.

The tuyere K has a throat, M, of the same slope as the cone N O. It carries at this point the air sucked by the piston to a speed of about 25 yds. per second. This is the speed found necessary to supply the sufficient quantity of gasoline for the carburation of the air. The liquid gasoline remains about ⅛ in. below the level of N when the piece I is off, but it rises by capillarity to the level of N in the grooves of the piece I. The third part of the apparatus, the mixing chamber, is shown in Fig. 4. It is composed of the simple mixing valve P with lateral apertures for the mixture and for the cold air. The latter is supplied by the pipe Q and regulated by the cock r.

The combined mixture goes to the motor by the suction pipe S. The valve P, which is a free fit in its case, is held by the spring flange T inverted for the admission of the mixture. The above part of the mixer and the pipe S are provided with the ordinary wire gauze employed in all carbureters (5 or 6 layers in our case).

Fig. 4 shows the general arrangement of the apparatus. In U is an ordinary tapped cleaning hole and around the vaporizer is seen the chamber V or warmer.

In the new Longuemare apparatus, Fig. 5, the constant level tank, the float, the vaporizer and the warmer are the same as those above described. The tuyere K of the vaporizer is different, as it is simply cylindrical and open at the lower part at a level below the spray level, an arrangement likewise similar to that of the Phenix Daimler Carbureter. The mixing chamber is also different. The fresh air which is carbureted in the tuyere is also supplied without carburation around the tuyere and the mixture is perfected at the perforated plate w, which opens or closes the aperture of the gas and the air. This plate valve is adjusted by the stem and handle above and is kept in place by a spring, as seen in the figure.

Besides that in D (Fig. 5) is the admission valve of the mixture. This valve is actuated by a second hand crank, X, concentric with the first one.

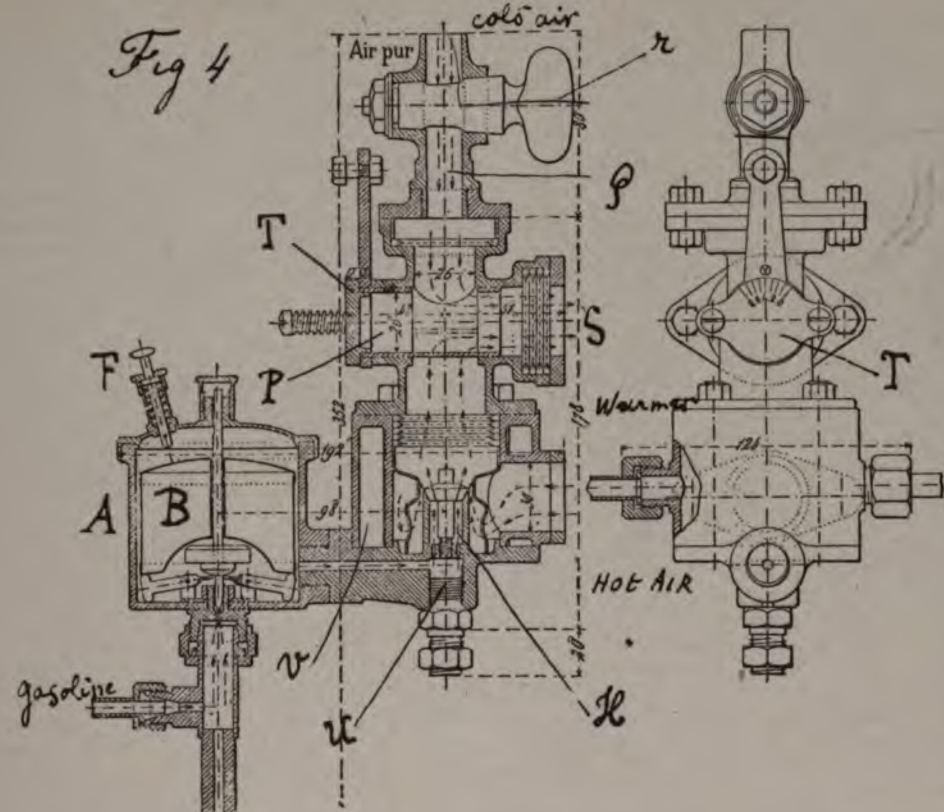
The whole apparatus is also more compact. The hot chamber or warmer is commonly placed around the vaporizer, something, however, below it.

This chamber is supplied by a pipe branched off from the exhaust pipe or from the muffler, and is regulated by a cock or valve.

Practically this warmer is used for the electrical ignition motor and the air is also preferably aspired in the neighborhood of the most heated parts of it, as, for example, between the radiating ribs.

In the common ignition by hot tube the air is drawn from above the chimney of the igniters or through the exhaust box.

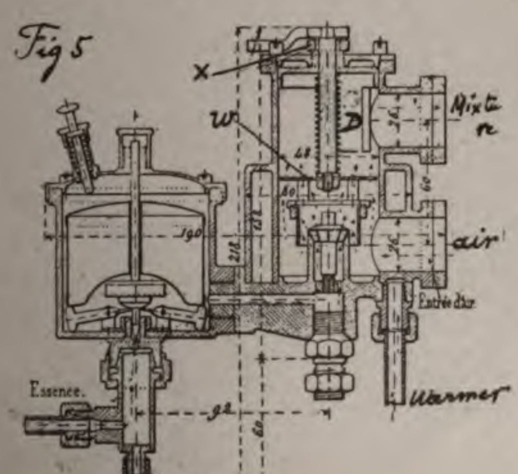
It is good also to protect the aperture of the suction pipe from dust by ordinary wire gauzes and in a point far from the exhaust.




The temperature of the air admitted in a vaporizer should be between 60 and 80 degs., or just high enough to maintain the evaporation and the required tension of the gasoline vapor and no more, this tension being otherwise given by the warmer.

It is easy to arrange a vaporizer to obtain this result, the tensions and latent heat of the gasoline vapor being known, and also the necessary surface of evaporation for spraying gasoline (about 1 sq. in. per cubic inch of gasoline per hour).

It is also generally good to place the vaporizer's level as far as possible below that of the inlet valve of the engine; the suction pipe also must have a diameter proportioned to the stroke volume and speed of the engine.




Certainly it is not good practice to make a vaporizer with a single pipe supplying gasoline in the inlet pipe, but the real practical apparatus, the ultimate form of vaporizer, must be developed from a complicated one, constructed with a view to theoretical perfection.

A throttle valve is also absolutely necessary in connection with it and should be actuated by the governor. We close this study by saying that while it is often supposed that uniformity of the temperature in a vaporizer is difficult to obtain, practically it is not so, and the devices described above are quite sufficient to insure it. The variation of temperature of the warmer, generally far from the exhaust pipe, does not change much whatever the quantity of gasoline evaporated, and the temperature of the indrawn air is always more disturbed in the cylinder of the motor than in the suction pipe and the vaporizer.

## COMMUNICATIONS.

### Two Plants and Their Products. Some Impressions.

Brooklyn, N. Y., March 29.

Editor Horseless Age:

While I do not wish in this communication to detract from the excellence of other manufacturing establishments that have recently been installed for the construction of automobiles, and that are, without doubt, equally important and equally deserving of commendation, still, inasmuch as I have had the pleasure of visiting but two, the impressions that are to follow have only to do with these two.

To my mind the progress that has been made by the Riker Electric Vehicle Company and the "Mobile" Company of America along the line of factory construction and equipment during the past few months, has been nothing less than marvelous. Again, I wish to say that more than likely I should be similarly impressed with the evidences of enterprise, activity and boundless faith in the future of the industry were it my good fortune to visit other works.

The Riker concern strikes one as being more nearly upon its feet—indeed, it seems to be running as smoothly as though some years had elapsed since its organization, instead of a few short months. This is partly because the company had no delay in waiting for the assembling of bricks and mortar—at least, there were side walls and roofs and floors and such appurtenances as windows and doors, together with a little available machinery, including an engine and boiler equipment, when they took possession late in the summer of last year. Since then the whole complicated armamentarium necessary for the carrying on of at least three lines of manufacturing has been gotten together and manned, and the completed vehicles are now being rapidly turned out. Thus we see the electrical department, where motors of many sizes and capacities are constructed, and controllers and other devices are built from the raw material. Then the gear making, with its draughting rooms, pattern shops, foundries, machine, forge and brazing shops, and finally, the carriage builders' department, where fine woods are first kiln-dried and seasoned and then shaped into all sorts of open and closed vehicle "bodies," having seating capacities of from one to 15 or 20 passengers, and then, after being ironed by the carriage-smiths and wired by the electricians, are trimmed with choice upholstery, and last of all, finished in any shade of pigment that the customer may select.

Everything in or about the electric vehicle is, or is soon to be, produced here except tires and lamps, the storage battery department being still embryonic as yet, however.

In looking about these vast works the layman has many impressions crowd through his mind—how much capital this all involves, what quantities of fine material is being consumed, how many patient hours of skilled labor are spent, aided by the most highly specialized tools and machinery—Ah, when you go out to purchase an electric automobile put money in your purses!

The Riker plant is not installed upon one of the upper floors of some city structure at whose entrance we perennially read that there are "Lofts to Let with Power," but is spread over a large tract of Jersey soil with the Central Railroad skirting it upon two sides. Here are large yards for the storing of lumber as it is unloaded directly from the cars, and the great array of buildings, ten or more in number, all isolated for light and ventilation, yet all connected by bridges, and all opening into one great central inclosure, into which the material and supplies are run upon a siding, and whose trussed roof covers an ample floor space for testing and showing vehicles. Everything is carefully planned and designed, and abundance of white paint and kalsomine give an air of freshness and tidiness about the interior, but the surrounding outlook is barren and uninteresting.

Perhaps the first impression that comes over one when approaching the works of the "Mobile" Company is that a love of the picturesque and romantic in nature must have inspired its officials to select the charming promontory that projects into the Hudson just above Tarrytown as a factory site. Commencing at the very nose of the "point," with the office entrances within just a few feet of the bluff overlooking the river, the long straight brick structure is rising, parallel with the promontory, so that from any of the numerous windows beautiful stretches of river scenery are visible, either up or down stream. What this means in the way of good light and pure air the medical man very well knows. Surrounding the buildings upon the land side is a magnificent park of some 200 acres covered with grand old trees that give refreshing shade in summer to portions of the buildings at least.

At present things are rather unfinished and chaotic—I believe ground was not broken until late in the fall of last year—but the wheels were started turning as soon as there were floor beams to secure shafting and pulleys, and now in March the first vehicle has been brought out and tested in mud, snow and ice.

At present the processes are not so varied as at the electrical works, as the bodies and engines are procured outside, but the machining and finishing of the forgings and tool steel stock, the coppersmithing upon the boilers, water and fuel tanks, the brazing, finishing and enameling of frames and wheels and the final assembling of all are in full blast. As at the Riker's, I was shown everything—there seemed nothing to conceal—and as a user of the automobile, was repeatedly asked if I knew of any way by which any portion of the product could be improved, the motto of both concerns evidently being everything shall be the best, the very best.

Now as to my impressions, Mr. Editor, regarding the two types of vehicles, electric and steam, the latter using a liquid hydrocarbon as fuel. The electric automobile is stately, elegant, dignified—a gentleman's carriage, free from disagreeable noises, odors, or escaping vapors or fumes, and as pleasant and simple to operate as need be. In fact, so little technical skill is required that any man, woman or youth can run it.

As built by the Riker Company, and I have no doubt by others, the vehicle itself requires but little attention to keep in order, and that not of a high order of mechanical skill, having but few moving parts all easily adjusted and not at all prone to deteriorate by use. With reasonable care and skill in handling the amount of service that can be obtained from this vehicle seems prodigious. I almost believe one could be run till the end of time and then be in fairly good shape, if no accident happened.

On the other hand, the battery situation should be clearly understood by the intending purchaser, for right here we come up against a serious drawback, so far as I am able to see. Unlike the vehicle itself, the battery does deteriorate, and that rapidly, consequently is expensive to maintain, if a satisfactory capacity is to be obtained, introducing an expense

item that is very considerable, as well as a source of care that is almost constantly present if heavy duty is required from it.

My impression of the steam vehicle, gathered from a painstaking inspection of the different steps of its construction, is that it embodies lightness, strength and durability to the highest degree, as does its prototype, the bicycle, framed like the latter of steel tubing with all connections drop-forged steel, not a single casting, with here and there a treacherous "blow hole," being in evidence. Every bearing beautifully machined and ground to the .003 in. standard from the finest of tool steel, as are also the hubs and axles. Such a piece of mechanism I could no more neglect nor in any way maltreat than I could a pet deer or greyhound, not that it is as full of grace as these animals, but like them, it is capable of terrific bursts of speed, maintained for long distances without resting, and so long as all goes well, at a trifling operating expense.

Now as to the other side of this picture. In the first place (this being again my own impression), while running this machine one is of necessity an engineer strictly and absolutely on duty, devoting very little attention to the beauties of nature and not attempting to be generally agreeable to one's companion.

Again, it is exceedingly difficult to run at night, as the ever-to-be-watched water glass cannot be seen. Still, again, it seems impossible to run at all when the temperature is below the freezing point on account of the liability of certain pipes to freeze. Lastly, the unpleasantness and obtrusiveness of constantly escaping exhaust steam, together with the danger accompanying a naked flame of highly inflammable gases under pressure, add to the objectionable features. It is my belief that many of these, as also those that go to make up the dark side of the storage battery, will be eradicated in the near future, and that each will rapidly find and fill its own sphere in the service of man.

What the immediate future, pregnant as it is with possibilities, will produce in these directions, who can tell? Of this I am confident, let the future evolution be ever so rapid, that Riker and the brothers Stanley will be long respected as among the most successful of the many men throughout the world high in engineering attainment who are arduously striving to bring forth that great ideal soon to be—the perfect automobile.

W. M. HUTCHINSON, M. D.

## Tests with Alcohol.

New York, March 27.

Editor Horseless Age:

As the fire insurance companies object to the use and storage of gasoline on the premises, and desiring to make some tests with a new gasoline motor, I tried to run same with gas, but found that I could get only about half speed by using it unless I made some alterations.

I then tried alcohol, hardly expecting to get any results, and, of course, the motor would not run. Thinking that it might run if the motor were first heated, as the air supply is heated by the motor, I started the motor with gas, the gasoline tank and vaporizer being filled with alcohol. To my surprise the motor started up to full power at once, consuming both gas and alcohol, and acting in every way as it had done before with gasoline alone. As soon as the gas was turned off the motor stopped at once, apparently showing that it was the gas which was ignited, this in turn igniting the vaporized alcohol.

As far as I could judge by the short tests made, there seemed to be a greater refrigerating effect from the vaporization of the alcohol than from gasoline, the pipes leading from the carburettor being much colder.

The amount of alcohol consumed was about the same as gasoline, so that the gas was additional to produce the power.

H. W. S.

## Mr. Skinner's Challenge Accepted.

New York, March 29.

Editor Horseless Age:

In your issue of March 28 I notice that Kenneth Skinner is prepared to race any motorist in America for a distance of 50 miles and upwards, either upon a track or road. I have much pleasure in accepting Mr. Skinner's challenge and am pleased to note that he demands it to be ridden off within a month. This suits me very well, as I should not be able to accept any race after April 26, owing to the close proximity of the Paris-Bordeaux race, for which I have entered. Therefore, the sooner Mr. Skinner can make full arrangements with me the better I shall like it. Yours truly,

C. G. WRIDGWAY.

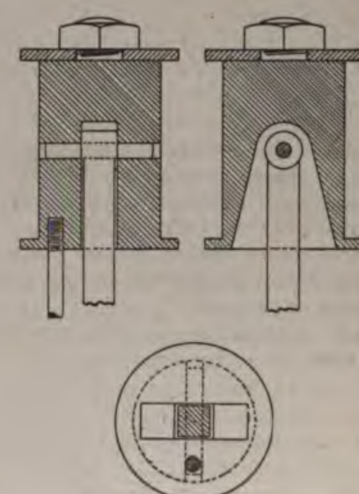
## Already in Use.

Helena, Ark., March 20.

Editor Horseless Age:

Will you please give me your opinion on the method of steering shown in the accompanying sketches? Has it or anything like it been tried, and is it practical?

W. H. WALKUP.



[The sketches show an inner hub pivoted at the end of the fixed axle by a vertical pin in the plane of the tire and furnishing a bearing on its periphery for the wheel hub proper. This system, with various modifications of detail, is used in the Riker and Clapp vehicles, and no doubt in others also. The main point is to get ample bearing for the pivot pin, as the leverage on it, in case of side strain, is considerable.—Ed.]

## Two Cycle vs. Four Cycle Vehicle Motors.

Buffalo, N. Y., March 31, 1900.

Editor Horseless Age:

The recent article of H. L. Towle, under the heading "Two-Cycle vs. Four-Cycle Vehicle Motors," is an extremely timely one and was very ably handled by the author. The ground was covered in a thorough manner, and shows a knowledge of the merits of the two engines beyond the experimental stage.

The writer would like to express his views in regard to the subject of the two motors and endeavor to confirm Mr. Towle's position.

Before going on, I would like to call the editor's attention to that class of inventors whom, in the writer's opinion, it would be well to steer clear of, to advance the success of the motor carriage. It has been the object of The Horseless Age to condemn anything that did not have merit, and so far as possible to insist on the truth in regard to motors and their accessories. I believe that it is policy for a responsible business house, manufacturing motors, to refuse to sell to individuals who are experimenters and whose ineffectual efforts to produce a cart that would operate might reflect seriously on the best of motors. The writer has in mind one carriage on which over $7,000 has been spent in the way of material and labor, which is to-day in fit shape for the scrap heap, with the promoters disgusted and withdrawing their financial support, and the general public incredulous of the success of a machine which is pushed back by hand, drawn in by horses, or towed with two or three bicycles pedaling, on other occasions stopping every block or two to take out a sparking plug, adjust some cam or grind on a crank with the usual public gathering.

It is this class of inventors that want prices on motors in thousand lots when they first start in, and we believe they do the business more harm than good.

To return to the matter of motors, it is the writer's candid opinion that there is no motor in existence so well suited for marine purposes as the well constructed and designed two-cycle motor. The more recent patterns have but three moving parts, and usually these are so arranged that they will take care of themselves, including the lost motion and oiling. In one class the compressed gas in the base is driven through a valve in the head. The object of this is to have a separate chamber in which to ignite the fresh incoming gas, but at the same time it wire-draws the igniting charge and thus decreases the force of the explosion.

In that class of engines in which the piston acts as a valve, a large free opening is allowed from the base to the space above the piston. With this construction there is less liability of a base explosion, as the piston covers the ports at the time the spark takes place and a base explosion is only caused by a poor sparking device, which fails to ignite the gas every time and lights back from the exhaust port across to the other side when both ports are uncovered, even sometimes igniting in the muffler.

Owing to the period of driving the gas into and out of the cylinder being limited to the opening and closing of the ports at the end of the stroke, and to the impracticability of running the compression in the base much above 12 lbs., the number of revolutions per minute is limited to the quantity of gas which can be gotten into the cylinder at each revolution and ignited by a strong spark.

In a launch, however, where the number of revolutions desired is from 200 to 600, the two-cycle motor can be built to operate within this range successfully. Bearings, however, should be provided with rings to prevent escape of gas, also piston rings should be provided to prevent escape around the piston into exhaust port; and what is more essential is ***a sparking device much stronger and more positive than is required on a four-cycle motor.*** The charge being less pure requires a much stronger spark. Taking an explosion at every revolution requires a stronger set of batteries, and the igniter that will perhaps prove satisfactory on a four-cycle motor will many times prove wholly inefficient on a two-cycle. It is also difficult to retard the time of ignition to as late a point in the two-cycle as in the four-cycle, as the gas will not ignite as readily owing to the degree of expansion which takes place after the crank passes the center; consequently it is necessary to retain a larger volume of gas to ignite every time than is necessary to do the work. This accounts for some two-cycle motors running away, as it is termed, and skipping when used in connection with reversible propellers, such propellers being placed in their neutral position.

For small motors the two-cycle motor can be made self-reversing or can be run in direction motor is started.

The sparking device should be located in such a manner that both points can be easily taken care of, and it should fire the gas at nearly the center of the clearance space, to consume as nearly as possible all of the gas in uniform time. The two-cycle motor made to skip explosions and take every alternate revolution will without making any change speed up and run faster than when running on the two-cycle principle, though on a direct pull it will not develop quite as much power.

When it comes to carriage work, the four-cycle motor has a number of essential points of superiority over the two-cycle. It requires considerably less water for cooling: the range of revolutions is from 100 to 1,000 in the average size of carriage motor: the disagreeable odor is much less: more liberties can be taken in the matter of muffling than with the two-cycle motor: and with a self-inclosed base oil can be used for a longer period of time in the four-cycle than in the two-cycle, as it is not discharged into the space above the piston. The two-cycle motor requires something of a load to keep it from racing. This is not true with the four-cycle, which, owing to the longer period of time to get the gas into the cylinder and the purer charge, can be ignited with such small quantities of mixture as to give only the necessary power. By simply controlling the throttle, double the range of speed can be had over the two-cycle motor. The two-cycle motor on a carriage has also a bad tendency to race in going down small inclines, while the four-cycle motor will not allow the carriage to run any faster than the speed the engine is throttled at, which is a great convenience in operating.

With two engines, one a 4 x 5 two-cycle and the other a 4 x 5 four-cycle, the four-cycle will deliver the greater maximum power and at a less fuel consumption.

Limiting the revolutions in the two-cycle at 500 and in the four-cycle at 1,000, we have an equal number of power strokes in each case, with a much greater M. E. P. in favor of the four-cycle. Yours truly,

W. S. HOWARD.

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**ACETYLENE MOTOR NUMBER IN MAY.**

# OUR FOREIGN EXCHANGES.

## The Eldin Pump and Vaporizer.

MM. Eldin and Lagier, 20 Place Bellecour, Lyons, whose improved Daimler motor was illustrated in our issue of Jan. 24, have lately brought out a new centrifugal water-circulating pump, which is shown in the illustrations. As will be seen, it is hung on springs and is provided with friction wheel driven from the motor fly wheel. The friction wheel is built up of two parts which support a leather disk between them, so that when the periphery of the latter becomes worn it can readily be renewed. The sectional plan shows the construction of the bearings and the method of securing water-tightness where the shaft comes out.

The same makers are supplying a vaporizer of the constant level type with float regulator, the principal feature of which is the use of a circular glass wall for the mixing chamber, so that the volume of the jet of gasoline can readily be observed. The mixing chamber is closed at its upper end by baffle plates or perforated diaphragms, which help to mingle the charge on its way to the cylinder.

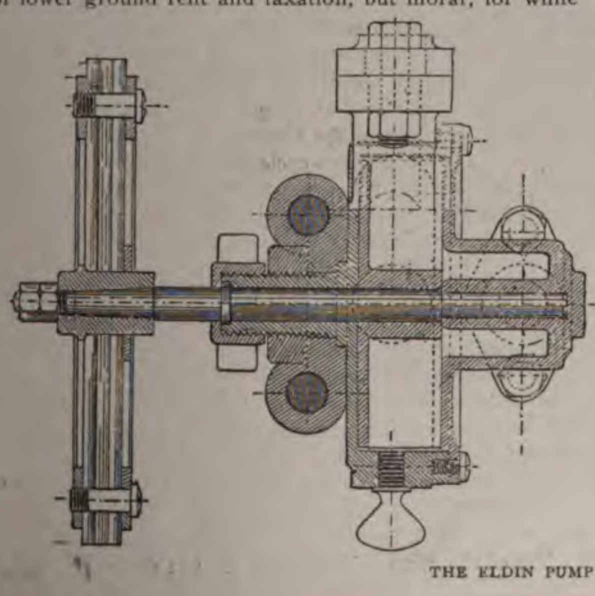
## The Thornycroft Steam Wagon Shops.

A motor vehicle concern that holds modern ideas as to shop equipment and treatment of its employees is the Thornycroft Steam Wagon Company, whose new works are located at Basingstoke, Hants, England. We condense the following description from The Automotor Journal:

The works are located on a site of 16 acres west of the town, backing upon the London and Southwestern Railway and connected with the latter by a siding. There is thus through rail connection with the Midlands and the North with the Welsh coal fields on the west, while Southampton is but some 20 miles further on. The site combines the best shipping facilities with the benefits of an open-air location in the country. These benefits are not only commercial in the way of lower ground rent and taxation, but moral; for while one might perhaps question whether the British workman always possesses a soul responsive to the beauties of nature, yet one could hardly doubt that this same workman would suffer by being transplanted to the city. The foreman of the shops has a charming cottage, with fruit and flower gardens surrounding it, situated on the estate and close to the works. In the neighborhood are well built cottages for the hands; but it is the intention of Messrs. Thornycroft to do for their workmen what Pullman in America and other enlightened employers have found to be the true policy to adopt if good industrial relations are to obtain between employer and employees—that is, to give the worker a good place to work in and a comfortable house to live in, with natural and civilizing surroundings. Already, as we shall see, steps in this direction have been taken, and in a few years these works will be a model industrial community.

The estate, as mentioned, covers 16 acres. Approaching from the roadway a gate keeper's lodge is first passed and beyond it is the building occupied by the business offices and the drawing room. This consists of one story, running east and west. The north side, which has very large windows, is allotted to the draftsmen, and the south side has desks for the clerical staff. There are also private offices for the superintendent, etc., and everything has been done to insure the comfort of the staff and the rapid dispatch of business. The wash rooms and water closets are in a separate building across the driveway from the offices and embody the best sanitary appliances.

Adjacent to the offices ground is being broken for a building to serve as mess room and recreation room for the hands, and near by is a well supplying water for the boilers and for domestic use. This water is pumped into a reservoir, which it is the intention to stock with fish and to surround with plants and shrubs. Following the drive, the main factory is next reached on the right and the power house on the left. The latter, built of corrugated iron, contains a 130 h.p. Babcock & Wilcox boiler, working 200 lbs. to the inch. This boiler is, however, to be duplicated shortly. Adjoining is the smith shop, with five forges, the blast for which is derived from an electrically driven Sturtevant blower. In the engine room is a "Belliss" compound vertical engine, direct coupled to a compound wound dynamo of 44 kw. capacity at 110 volts which supplies current for both light and power.



THE ELDIN PUMP AND VAPORIZER.

The main factory, like all the other buildings, is one story high and is built entirely of iron and steel with concrete foundation, on which is laid a floor or paving of wood blocks. The framework is of channel and H steel sections, inclosing a space 120 x 140 ft.; the roof is laid out in six spans of "saw tooth" section with the north slopes of glass and the less steep south slopes boarded and covered with corrugated iron, and the columns supporting the roof are utilized for attaching the shafting hangers. The walls are of corrugated iron and the north side is well supplied with large windows, so that there is altogether an abundance of light with no direct sun rays. The foreman's office, on the west side of the factory, is raised some feet above the floor level, and from this position every machine is under observation. Immediately in front of the office are the erecting pits, over which the vehicles are placed during erection; there are two of these pits and each accommodates four vehicles.

The tools in the main shop are all up to date and comprise examples of the best English and American practice, for Messrs. Thornycroft are extremely catholic in their tastes. All the machines are driven on the group system by motors mounted on brackets attached to the columns; each of these motors is of about 15 h.p. When full the shop will accommodate 350 hands; but at present, owing to its incompleted state and the difficulty of securing men, only about 60 or 70 are employed. The shop is warmed in winter by large stoves.

At present the capacity of the factory is one steam wagon per week; with the completion of the works this will be at least two per week. It is the intention of the company to build for stock if they can, but the demand is increasing, and at present the prices are considerably higher than they were.

## The Georges Richard Sparking Plug.

The ordinary sparking plug consists of a metal spindle passing down the center of a porcelain tube, its end being near another rod which is connected to the main body of the motor. Between these two rods the spark passes. The rod passing down the axis of the plug is fixed, either by some kind of cement or by two screws, which hold it between their ends.

These two systems have their advantages. Under the influence of the high temperature cements deteriorate, while, on the other hand, if the rod is fixed by means of screws it comes about that, owing to the difference in the expansions of the rod and the porcelain, the joints are altered in such a way that a current of gas or air sufficient to extinguish the spark may be produced around the rod.

The figure indicates the method by which M. Georges Richard seeks to avoid these causes of breakdown. A is the porcelain tube inclosing a metal rod, B, at the end of which is a head, C, separated from the end of the porcelain tube by a copper washer, a. Close to the head C is the rod, b, which is connected to the mass of the motor. At the other end of the tube is an asbestos washer, c, over which is another copper washer, d. A spring, R, presses against this washer.

According to the usual practice the rod B has its end threaded to receive the nut D, by means of which the rod B is firmly held in the porcelain tube, this nut D receiving the conductor e of the electric current, e being held by the thumb screw f.

Owing to the spring R, which is compressed by the screw D, the head C is pressed firmly against the tube A and there is also a tight joint at the other end between c d and A. Thus a good joint is formed which does not allow the passage of gas or air when the parts expand, the difference in expansion being met by the action of the spring.—La France Automobile.


## The De Dion and Bouton Starter.

Figs. 1 and 2 show two sections of this starter; a is a shaft connected to the shaft of the motor by gearing at b, giving a convenient relative speed; c is a part of the frame. On the shaft a turns freely a toothed wheel, d, the hub e of which is prolonged to one side, and carries a ratchet wheel, f. At the end of the same shaft is keyed a drum, g, inside which are several semi-circular webs or beads, which hold the axes

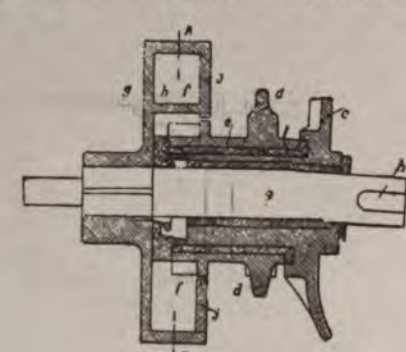


FIG. 1.

of the tumblers i which engage with the ratchet wheel f. These tumblers can turn freely in their cells, being held in place by the drum g and a cover plate, f. The driver can turn the wheel d by hand gear in the sense of the arrow z f turning with it. The teeth of f catch the tumblers i and so turn the drum g in the same sense. When the motor starts it turns g by means of the shaft a, the tumblers first slipping past the teeth, and then being held by centrifugal force against the inner face of the drum (shown in Fig. 2) in the position i'; thus


FIG. 2.

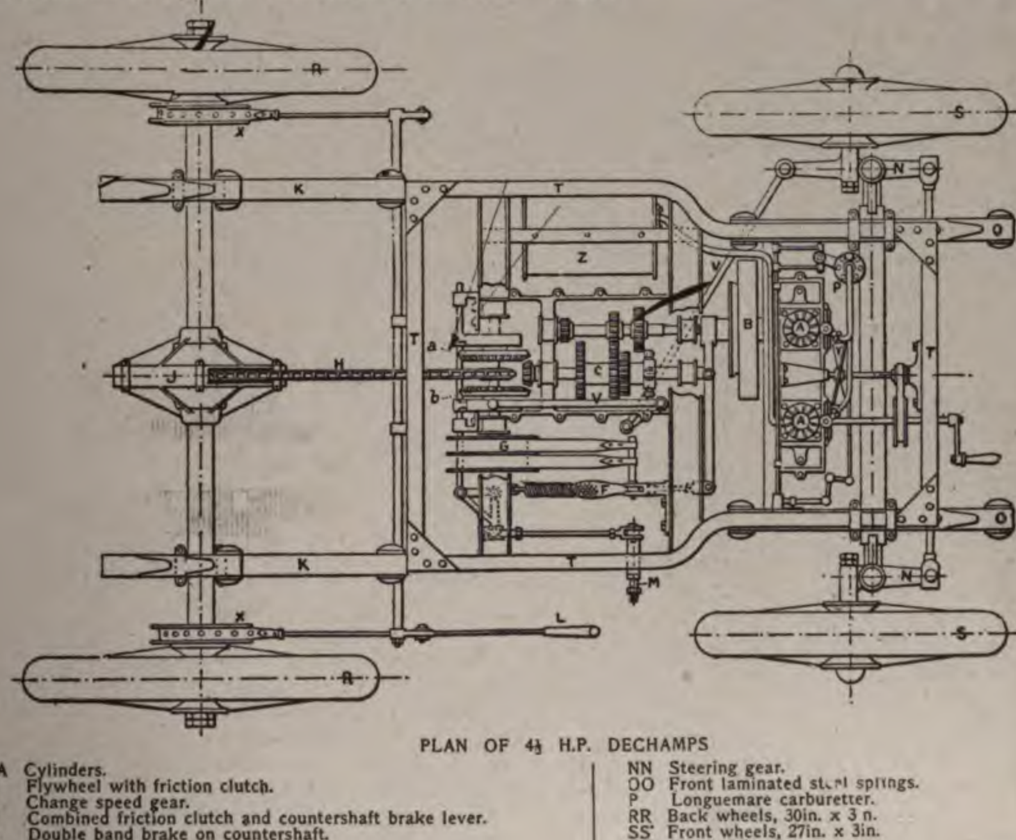
they are out of gear when they are not wanted.—La France Automobile.

## The Dechamps Carriage.

The Autocar thus describes the 4½-h.p. Dechamps carriage:

"The plan shows the arrangement of the two-cylinder motor. The diameter of each cylinder is 3 in. and the stroke 3½ in. Air cooling alone is depended upon, a large fan being driven from the motor shaft at 4,500 revolutions per minute, with screens so arranged that the fierce current of air thereby set up infringes chiefly upon the region of the valve chambers, and as a user tells us that he has driven the car at a high speed for 100 miles without stop and that no tendency to overheat resulted from this severe test. In addition to the usual splash lubrication, cylinder lubricators are provided. In the plan B is the fly wheel with the usual friction clutch. The train of toothed wheels marked C is the change speed gear by which the three speeds—8, 16 and 30 miles per hour—are obtained either ahead or astern. Forward or backward movement depends upon just which of the two bevel wheels a and b on the countershaft are in gear with the pinion between them, the engagement of these wheels being controlled by the lever M and its connections. The drive from the countershaft is taken by the chain H to the toothed wheel in the differential gear box J, so that this, like the 9-h.p. Dechamps, to be run in the 1,000-mile trial, has a live driving axle. The latter is probably the highest-powered pleasure car made with a live axle. The clutch B is controlled by the pedal F, which depressed beyond half distance applies the two band brakes G on the countershaft. Two powerful band brakes X X on the driving wheels are applied through the lever L, so the car is amply provided in this respect. The car runs on strongly-built cycle wheels 32 in. in diameter, shod with 3½-in. pneumatic tires, and running on ball bearings. The body, which is of comfortable and elegant design, is luxuriously hung on C springs as to the rear portion, and elliptical springs forward. A Longuemare carbureter is used, and the petroleum tanks have a capacity of 10 gals. The car has the appearance of a self-contained, self-propelled vehicle, and does not present any lost-horse appearance. With regard to ignition, electricity is employed, four trembling coils being carried with the accumulators under the seat. The racing car weighs 1,200 lbs., and the front wheels are the same distance apart as the back, not closer together as in the 4½-h.p. pattern."

In default of a photograph suitable for reproduction we may add that the motor is inclosed under a small ventilated bonnet just in front of the dashboard, and that a sight-feed oil tank with distributing pipes to the different bearings, is located with some of the controlling levers at the top of the dashboard.




PLAN OF 4½ H.P. DECHAMPS

AA Cylinders.
B Flywheel with friction clutch.
C Change speed gear.
F Combined friction clutch and countershaft brake lever.
G Double band brake on countershaft.
H Driving chain.
J Differential gear box.
K C springs.
L Hand lever for putting on band brakes XX.
M "Forward" and "backward" movement lever, operating bevel wheels "A" & "B."

NN Steering gear.
OO Front laminated steel springs.
P Longuemare carburetter.
RR Back wheels, 30in. x 3 n.
SS Front wheels, 27in. x 3in.
TT Channel frame.
V Steering lever.
XX Back band brakes.
Y Cooling fan running 4,500 revolutions per minute.
Z Silencer (second silencer not shown).

## MINOR MENTION.

Arnold Samuels, Moline, Ill., is building an automobile.

The Locomobile Co. have opened an agency at Plainfield, N. J.

The Century Motor Vehicle Co., $25,000 capital, has been formed at Syracuse, N. Y.

Dann Bros. & Co., New Haven, Conn., are supplying bent wood for motor carriage bodies.

Phineas Jones & Co., wood wheel makers, Newark, N. J., are distributing as a souvenir a small silver stamp box.

An electric vehicle charging station, accommodating 80 vehicles, has been leased at Long Branch for the coming season.

Four carloads of Wood's electric carriages passed through Cheyenne, Wyo., recently en route to Honolulu, H. I. Each car contained six carriages.

The law limiting the speed of automobiles to 10 miles an hour at Newton, Mass., is to be enforced owing to the many complaints of excessive speed.

The Boston Gear Works, Boston, Mass., are now furnishing rawhide and fiber gears for motor vehicle transmission. Their compensating gears for differential drive are known the whole country over.

James W. Tygard, who has succeeded to the business of the Tygard Co., Pittsburg, Pa., has purchased the property at No. 36 New Chambers St., corner Rose and Pearl, New York, and will shortly have on exhibition there one of his reversible rótary gas engines.

The Motsinger Device Mfg. Co., Pendleton, Ind., have incorporated, with $50,000 capital stock, the town having given the company free gas for fuel. A building 50 x 100 ft. will be erected for a factory. In consequence of the large demand, a reduction in the price of the Auto-Sparker has been made.

The United States Long Distance Automobile Co., capital $1,000,000, has been incorporated in New Jersey by Lewis Nixon, Lieut. John C. Fremont and David J. Newland. There are 1,000 shares of preferred and 9,000 shares of common stock. The company's headquarters are at Lewis Nixon's Crescent Shipyard, Elizabethport, N. J.

The bill incorporating the Union Automobile Company, of Maryland, has been amended so that the company cannot operate in Baltimore without an ordinance of the Mayor and City Council giving consent, in which case the company must pay to the city 5 per cent. of its gross receipts. The company cannot use the tracks of the street car companies without paying for the use of the same.

Thomas M. Moore, chief of transportation and machinery exhibits at the Pan-American Exposition, to be held at Buffalo, N. Y., from May 1 to Nov. 1, 1901, seeks the co-operation of motor vehicle inventors and manufacturers in making the motor vehicle display and its attendant spectacular features a pronounced success. He has already been assured of the assistance of many of the leaders of the new industry.

## METROPOLITAN NOTES.

William R. Winn, 143 Maiden Lane, keeps motor gasoline at wholesale.

R. G. Du Bois, St. Paul Building, has opened an agency for the sale of automobiles.

The Empire Rubber Mfg. Co., 88 Reade St., are now making solid rubber tires for motor vehicles.

The Prentiss Tool and Supply Co., 115 Liberty St., are selling agents for the Carlson & Holmgren Toggle Drawing Press, described in our last issue.

Manning, Maxwell & Moore will soon issue a new catalogue showing a number of machine tools specially designed for the manufacture of motor vehicles.

The Standard Valve Co., 136 Liberty St., have now perfected their cap valve for automobiles by making it of greater pumping capacity without requiring a larger cot than the one used on regular sizes. The deflating principle of the valve is one of its greatest advantages.

We understand from Gilbert & Barker, 82 John St., that numerous stations are being located at various points in the city and suburbs for the sale of gasoline to motor vehicle owners. They supply the gasoline only in bulk to these stations, which in turn retail it to the consumer.

At a special meeting of the Automobile Club, held last Thursday evening, Clarence Gray Dinsmore was elected delegate to represent the club at the Gordon-Bennett Cup races next June, and John H. Flagler was elected vice-delegate to serve in the event of the delegate's absence or disability. Albert C. Bostwick was chosen delegate to the International Motor Congress at Paris.

The Automobile Club of America has appointed the following technical committee to act as an advisory committee on all technical matters connected with runs, tours, exhibitions, tests, etc.: C. J. Field, chairman; Prof. R. H. Thurston, Cornell University, Ithaca, N. Y.; Prof. Elihu Thomson, Swampscott, Mass.; T. Cummerford Martin, editor Electrical World and Engineer, New York; Dr. S. S. Wheeler, New York, and Carlton Macy, New York.

## Automobiles Classed as Household Effects.

A recent inquiry of J. R. Roosevelt, of New York City, as to the status of the motor vehicle before the customs laws, has brought out a ruling from the department. He wished to know whether an automobile, which he desired to take to England with him to use there for a few months, could be brought into the United States again free of duty under the provision of the tariff law regarding the free reimportation of personal effects taken abroad by residents of the United States. In reply to this inquiry the department has decided that as the automobile in question is of foreign manufacture, it would be liable to duty on reimportation within a year. If used abroad, however, for one year or more, it would be entitled to free entry as a household effect. While the automobile is not to be regarded as a personal effect within the contemplation of the tariff act, it may be classed as a household effect.

# MOTOR VEHICLE PATENTS of the world

## UNITED STATES PATENTS.

No. 645,902—Motor Gearing.—Elmer A. Sperry, Cleveland, O., assignor to the Cleveland Machine Screw Co. March 20, 1900. Application filed Aug. 25, 1898.

The invention relates to a low-speed or hill-climbing gear, with means for controlling the same. Although the specifications are not restricted to electric motors, the apparatus is designed with especial reference to them, and includes an interlocking device to prevent the current controller from being moved except when the low-speed gear is either wholly in or wholly out of mesh.

In Fig. 1 A and A′ are the wheel axles, journaled in A″ A″ and driven by the differential shown. The latter carries the spur gear C on its periphery and is in its turn driven by the pinion D.

The motor pinion b′ drives the gear b, which is fast on the shaft D′ and is provided with the screw-actuated conical brake shown, the whole being inclosed by the fixed yoke c′ and the case or housing $b^4$. The shaft D′ is journaled as shown and carries the clutch D″, which is preferably of the

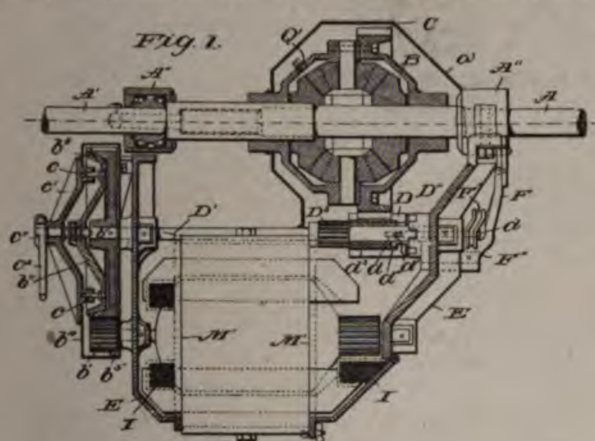


Fig. 1.

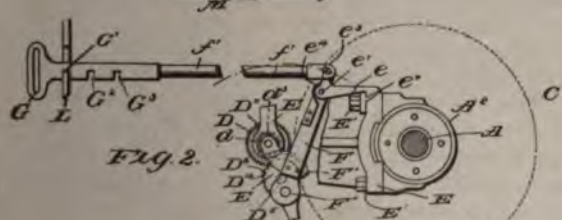


Fig. 2.

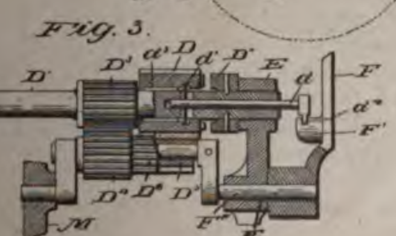


Fig. 3.

positive drive type and is keyed fast to D′. The pinion D (best seen in Fig. 3) is freely mounted on the shaft D′ through the rollers $d^3$ and is likewise free to move lengthwise, in order that the clutch teeth on its right-hand end may engage or disengage with the clutch D″. This lengthwise movement is effected by the stem d, carrying the pin d′, which moves in the slot shown in the shaft, and at its ends engages the circular internal groove in the pinion D. This stem d has at its outer end an engaging pin, $d^4$, working in the grooved cam F′, which is mounted on the lever F.

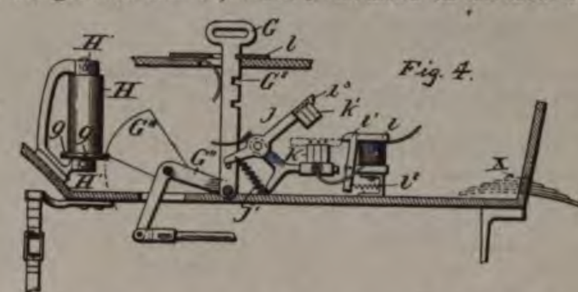


Fig. 4.

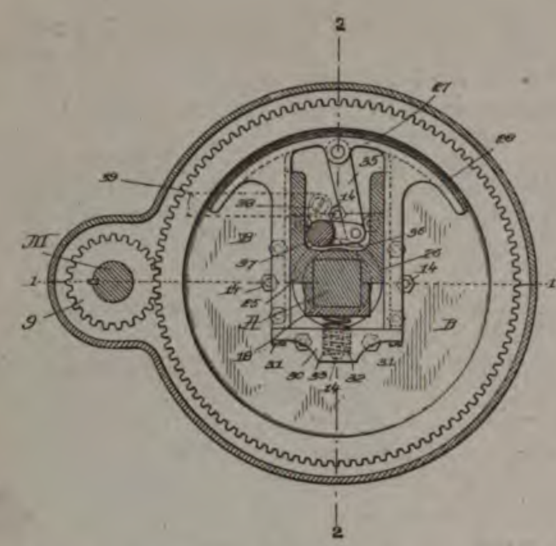
This lever F moves also the swinging shaft $D^5$ (see Fig. 3), on which the double pinion $D^4$ $D^6$ is free to turn. $D^4$ is driven by the pinion $D^3$, which is fast on D′, and from the sizes of $D^4$ and $D^6$ it will be seen that the series will reduce the speed of D when engaging with it. The arrangement of the swinging shaft and the cam F′ is such that, starting with the lever F at one extremity of its throw and the pinion D in clutch with D″, D will be wholly released from D″ before the pinion $D^4$ $D^6$ comes into mesh with $D^3$ and D, and there will therefore be an intermediate position of the operating handle, such as $G^2$ in Figs. 2 and 4, in which the motor will turn without driving the axles. A latch is provided at the head of the lever F to retain it in the position shown and relieve the strain on the rod f′.

In Fig. 4 the controller H has a flange g with notches, g′, cut in it, allowing the segment $G^4$ to pass through. The handle G controls the speed gears above described, and as the segment $G^4$ is made fast to the bell crank G″ and moves with it, it is clear that the controller can be turned only when $G^4$ is in its extreme position, up or down. An automatic circuit breaker is shown at i i′, etc., and the knife $i^2$ of the switch k is arranged to be again thrown into contact by the same (upward) movement of the handle G that unclutches pinion D and engages the low-speed gears; the idea being that an excessive current indicates that the low-speed is needed, and it is therefore natural that the same movement should perform both operations.

Ten claims.

No. 645,926—Brake for Vehicles.—Perry D. Blackden, Everett, Mass. March 20, 1900. Application filed July 5, 1899.

The view shown is looking outwardly from the center line of the vehicle. g is the driving pinion and B the gear on the wheel hub, dished to contain the brake head 27 and operating mechanism. The surrounding case extends over the outer side of the gear, and is closed on its inner side by a flat cover which is bolted to the frame, and from which the squared sleeve 18 projects into the case to hold the axle. The rock shaft, 37 passes through the cover, having the crank arm 36 inside and the crank arm 38 outside, and the link 39 connects the latter with the brake lever. The brake head is held normally out of engagement by the spring 32. The gear B is bolted to a flange on the wheel hub by the bolts 14, and

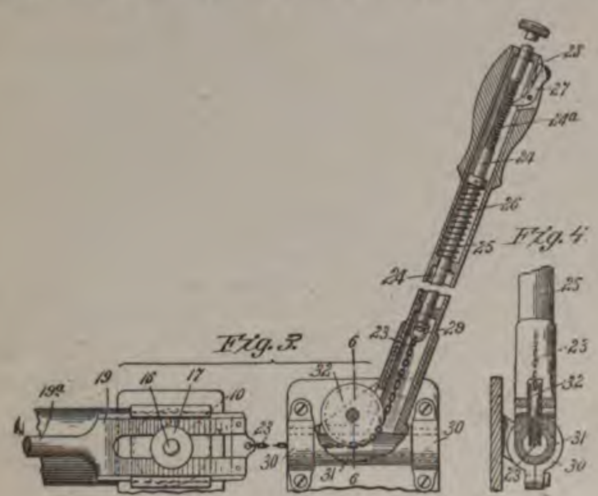


the axle A extends through the hub for a bearing. The guide 26 is secured to the inner face of the cover, and is tongued as shown by the dotted lines.

Six claims.

No. 646,399—Explosive Engine.—James F. Duryea, of Springfield, Mass. Dated March 27, 1900. Application filed Sept. 19, 1898.

The patent relates to a means for regulating the amount of mixture drawn in by means of a wedge-shaped stop which limits the opening attained by the suction-lifted inlet valve. In the figure the valve disk is shown by 10 in dotted lines; 16 is the outer end of the valve stem and 17 is a round nut for adjustment. The forked wedge 19 is tongued to slide longitudinally and is controlled by two springs of which one

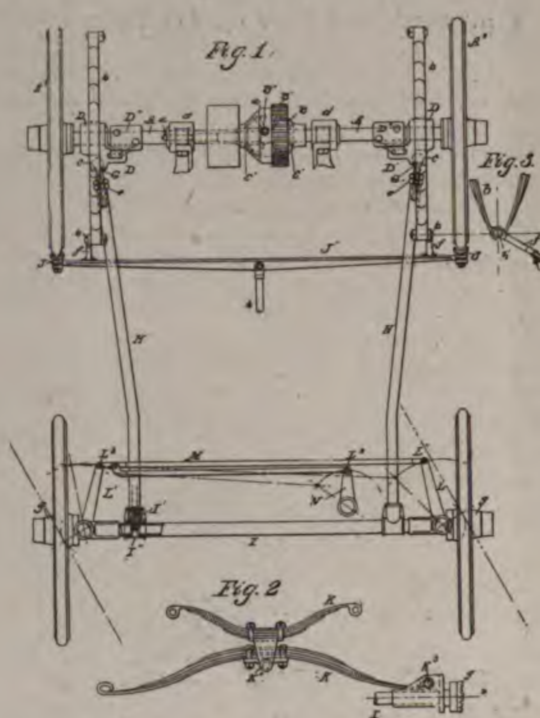



(not shown) on the stem 19 a tends to draw the wedge to the left, while the second and stiffer one 25 in the steering handle shown, normally overcomes the first and carries the wedge to the right, in which position its left-hand or thinner end is under the nut 17 and the lift of the valve is a maximum. The intermediate positions of the wedge are regulated by pressure on the button on the end of the plunger 24, which is held where placed by the pawl 27.

Three claims.

No. 646,081—Gearing for Motor Vehicles.—Elmer A. Sperry, of Cleveland, O., assignor to the Cleveland Machine Screw Co. Dated March 27, 1900. Application filed Aug. 19, 1898.

The specifications describe a rear driving axle in two parts, A and A′, the end of one being enlarged and bored to receive the end of the other, as shown in Fig. 1. The case a of the differential is split and each half engages collars c′ c′ on the two parts of the axle, thus preventing the separation of these parts. The journal boxes D D support the weight of the body through the elliptical springs b b and have also guiding loops or sockets D′ D′ which loosely engage guiding pins projecting from the bottom of the vehicle body.




Provision is made for adjustment of the frame to inequalities of the road surface by articulating the reach rods H H in ball joints at c c. The sockets of these joints are preferably cast around the balls and provision is made for taking up wear by making the sockets split on one side and contracting the split by tightening-screws. The body of the vehicle will therefore tend to follow the inclination of the rear axle, and the front springs are therefore made as shown in Fig. 2 with the joint K″ between the upper and lower springs. The loop joints K³ permit lateral springing of the frame and also allow springs K to flatten under load.

Thirty-one claims.

No. 646,386—Hydrocarbon Burner.—Milon O. Godding, Los Angeles, Cal. Dated March 27, 1900. Application filed Dec. 29, 1898.

This is a steam jet atomizer for crude oil and the apertures for oil and steam are made adjustable by the screw plugs 5 and 9. The recesses in the plugs and in the lip separating the two apertures are to equalize the force of the flow of the oil and steam and render it more uniform throughout the width of the jet.

Four claims.

## SPECIAL NOTICES.

**Advertisements Inserted under this heading at $2.00 an inch for each issue, payable in advance.**

### ATTENTION.

Castings of Gasoline Motor described in The Explosive Motor Number of this paper. Also other sizes—stationary, marine and vehicle motors—rough or partly finished. LOWELL MODEL CO., Box 292, Lowell, Mass.

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# THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. VI. NEW YORK, APRIL 11, 1900. No. 2.

THE HORSELESS AGE.

**E. P. INGERSOLL, Editor and Proprietor.**

PUBLICATION OFFICE:
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**HERBERT LADD TOWLE, Associate Editor.**

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THE HORSELESS AGE, 150 Nassau Street, New York.

**Entered at the New York post-office as second class matter.**

**On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.**

E. P. Ingersoll, Editor of The Horseless Age, is making a trip through the West, which will occupy a month or more.

## For the Mutual Good.

Among the obstacles which have to be overcome by the motor carriage in winning its way into universal favor, and by far the most formidable, is unquestionably the almost universal ignorance of the public regarding its nature, capabilities and handling. In the latter particular even the users of motor carriages have at first much to learn, and unfortunately they have to gain most of their knowledge unassisted, and at their own expense. The lessons given by the dealers in these vehicles relate chiefly and necessarily to the matter of control, since it is, in the nature of the case, impossible to give each purchaser a complete mechanical education, with instructions what to do in any one of the hundred and one contingencies which will inevitably arise. The pupil therefore goes through these lessons with the assumption that the vehicle is in perfect order, and his education in the art of keeping it so begins only when he gets the vehicle on the road.

It is at this point that all the users of motor carriages can derive mutual benefit by exchanging notes of their experiences in the handling of the machine and its maintenance. It must doubtless be admitted that the owner of an automobile, who is not blessed by nature with an instinct for things mechanical, is in a desperate case, and a weekly visit to the repair station is probably his only hope. We believe, however, that most owners of motor carriages have acquired them because they take pleasure in possessing and operating such a piece of almost sentient mechanism as a good motor carriage soon proves itself to be. These persons are not by any means mechanics by profession. They may be physicians, lawyers or men of business; but either at once, or before they have handled a carriage long, they begin to feel an interest in its mechanism for the mechanism's sake. If breakdowns occur, as breakdowns will, they take pride in telling just how they tided over the difficulty; how they disconnected a cylinder, patched the sprocket chain together, traced a short-circuit, or tied on a tire. Doubtless they soon learn, but unquestionably they would be better prepared for the emergencies as yet unencountered, if each had the benefit of the other's experience.

The Horseless Age urges every one who has had experience of the sort that is not covered in books to use its columns in describing the same. It takes time to sit down and write a letter, but we are sure that the writer will, in the end, be benefited by the responsive efforts of others, and by the discussion which we hope will be evoked by such communications.

Wherever sketches are needed to make clear the writer's meaning, we would urge that they be made. No matter how rough they are, we will see that they are properly reproduced.

## A Step in the Right Direction.

The appointment of an advisory committee by the Automobile Club of America shows that it intends to make the automobile something more than a mere excuse for social functions. The committee is to conside all questions relating

to tours and runs, and to exhibitions and tests of different vehicles.

If the matter of competitive tests is taken up seriously, the club can do great service in the cause of automobilism. Such exhibitions will not only serve to give publicity to the new method, but will be of value to builders and users alike, and we hope that the Automobile Club will use its best efforts in this direction.

The Transcontinental Highway, proposed by the Automobile Club, will be a good thing when we get it. It seems a mistake to us, however, to call it a National Highway. At best it will be a highway connecting the counties through which it runs, and no automobilist, tourist, or tiller of the soil is likely to journey from one State to another over dirt roads and stones in order to share in its blessings. What we want is reasonably good roads—roads which shall be durable without being sandpapered, through every county of every State.

## The Aftermath.

The Westminster Gazette prints the following: Since their flotation, the Lawson motor companies seem to have spent most of their time in defending actions brought by shareholders desiring the return of their money. There have been negotiations, and the directors have come to terms—they have even reconstructed to wipe off old scores; but still the actions continue. The latest is that of Frankenburg vs. the Great Horseless Carriage Co.—the Great Hopeless Carriage Co., as it has been called. On the allegation of misrepresentations of fact and of misleading concealment in the prospectus, he has obtained legal victory over the company, and the company's appeal to have the action dismissed has just been lost. It claimed that it had gone into liquidation, that the assets had been transferred from one company to another, that the action was frivolous and vexatious, that the plaintiff had sat down for three years after the allotment of shares to him and for eighteen months after the liquidation—and yet the court favors Mr. Frankenburg. It refuses to dismiss the action, and declares that the company must take its stand and plead.

## A Prize Essay on Speed.

[It will be recollected that Henry Edmunds kindly offered, through the committee, a prize of £10 for the best essay on Speed. The following is the essay which has been adjudged to be the best of those submitted]:

In arriving at a satisfactory definition of what should be the speed of a motor vehicle it is necessary first to consider separately each class of such vehicles, and taking as a whole the entire body coming within the Government tare limit. I propose to divide it into three classes and consider each on its merits.

Two other vital points should be considered, these being first, the construction of the carriages themselves, and second, the conditions of the locality where they may be used. To take each point seriatim:

First—Construction.—Commencing with the heavy motor vehicles first, these being for the sake of brevity all vehicles of above 2 tons tare weight unladen. It appears for this class the Government limit of 5 miles per hour is fair, for although it seems reasonable that a speed of 6 miles might be permitted, yet in a heavy vehicle the increased vibration and consequent wear at speeds over 5 miles per hour are at present very marked, unless rubber or pneumatic tires are used, and here so far they have not proved the success they have been on lighter cars. It is significant that nearly the whole of the British heavy motor vehicle builders state that for this class there is little advantage in exceeding the Government limit.

Coming to the second class, however, which comprises those varying between 1 and 2 tons, and assuming the employment of rubber in some form for the tires, we find a higher speed might be permitted; this, in the writer's opinion, being a maximum on main roads of 15 miles per hour. This speed, with the advantages of modern construction, and the provision of two powerful and independent brakes, should be perfectly safe. No definite advantage seems to be gained, judging by English experience, in exceeding this, while on the other hand, there is considerable risk. These remarks, of course, apply to English conditions, and in no way apply to those cars employed on the continent or specially built for racing purposes.

The last class, which is that of all vehicles below 1 ton tare weight, and, of course, includes motor cycles of all descriptions, again on the point of construction permits of a very high speed being safely employed, both on account of their lighter character and also the fact of their being usually fitted with pneumatic tires. On the other hand, it should be remembered that this class is far more numerous, and therefore the speed should not be too high. For the reasons before stated, it seems that 20 miles an hour should be the maximum for this class on main roads.

Second—Locality.—It is obvious this is an important point. As before stated, on good main roads a high speed rate may be permitted, but for street traffic the conditions are entirely different. Bearing in mind the strong point of the difference between the general conditions in England and the great nations of the Continent, for example, the French, both as to the roads and laws affecting motor cars, we must remember the entirely different aspect of the question in each case. It is to be feared that in a small country as Great Britain, and with the numerous interests and prejudices to meet and study, a single set of regulations would not operate fairly in each district.

The writer may, however, indicate that the estimation and regulation of the speed of motor propelled traffic should not be left to persons with little or no knowledge of the subject, and would venture the proposal that should the growth of the motor vehicle industry continue, each large center of traffic should be provided with a certain number of competent persons to be attached to the police force, these being properly certified and examined, and who should be stationed at proper points for the express regulation of motor vehicle traffic. As to the first class of vehicles the speed may well remain as before for street traffic, for experience shows that the heavy motor vehicles at 5 miles an hour are under perfect control, and there are very few localities where this speed might be called excessive.

It is, however, very different with Classes II. and III., which I will consider together. In order to protect foot passengers and users of the highway, I would suggest that in passing through towns the speed of each class be reduced to one-half for Class II., and one-third for Class III., i. e., 7½

miles and 6 2-3 miles. If, however, this is considered awkward, I would suggest the alternative plan of reducing both classes to a uniform speed of 8 miles an hour through towns, and this speed not to be exceeded on cross roads less than 20 ft. clear width. It is perhaps too much to expect, but considering the fact that these classes are by far the most numerous and also that action is being taken by local authorities to get the speed of motor vehicles reduced, it is suggested Parliament might be approached with a view of preventing interference with motor vehicle speed by local bodies, by fixing a minimum speed for these vehicles as far as regards Classes II. and III., below which (except as stated through towns) it should be impossible for these authorities to reduce it without proper authorization, or the proof of the state of the traffic or locality demanding it, and that if such was the case a board should be placed prominently visible with directions as to speed reduction in large letters similar to the well-known "Cyclists'" danger boards.

With the provision of traffic regulation by certificated experts and the enforced observance of the rules of the road by all, the foregoing speeds should be perfectly safe.—Automobile Club Notes.

## For a Transcontinental Highway.

The Automobile Club of America held its first dinner Monday night, April 2, at the Waldorf-Astoria Hotel in this city. The especial object of the occasion was to start the agitation for a transcontinental highway, and several prominent speakers were on hand to urge the cause along. These include, among others, Gen. Nelson A. Miles, head of the committee having the matter in charge; Col. A. A. Pope, ex-Mayor William L. Strong and Isaac B. Potter, ex-president of the L. A. W. Others present were Col. Peter Michie, of the West Point Military Academy; Col. R. L. Hoxie, of the Corps of Engineers, U. S. Army; Col. S. E. Tillman, of West Point; Francis E. Stanley, of Newton, Mass.; Col. John Jacob Astor, Julian Hawthorne, A. R. Shattuck, chairman of the club's committee on good roads, and Amzi L. Barber.

About a hundred persons were present, and resolutions were adopted which began by proposing a route from Portland, Me., through Boston, Albany, Syracuse, Rochester, Buffalo, Niagara Falls, Erie (Pa.), Cleveland and Toledo (O.), Adrian and Coldwater (Mich.), Elkhart and South Bend (Ind.), Chicago, Davenport, Des Moines and Council Bluffs (Ia.), Omaha, Lincoln and Hastings (Neb.), Denver, Salt Lake and Sacramento to San Francisco. A southern branch from St. Augustine through Savannah, Charleston, Richmond, Washington, Baltimore, Philadelphia and New York to Albany, and Pacific Coast branch from Seattle through Portland (Ore.) and San Francisco to Los Angeles were likewise proposed. The resolutions further recommend that Congress be petitioned to authorize a survey of the route named, such survey to be performed in four sections and if possible within four years, the section between Boston and Chicago the first year, that between Chicago and Omaha the second year, that between New York and St. Augustine the third year, and the remaining portions the fourth year. It was proposed that the expense be met, one-third by Congressional appropriation, one-third by the States for those portions lying within their respective boundaries, and one-third by the counties, towns and cities through which the road should pass, while the owners of the property benefited be asked to donate the right of way. The need of ample width and of the avoidance of curves, to meet the conditions of automobile travel at high speed, was dwelt upon, and a right of way of 120 ft., with road width (for the present) of half that, was recommended.

The speeches after the resolutions were adopted dwelt on the benefits of the proposed highway, not to automobilists alone, but to farmers and the countryside in general.

## Automobiles in Boston.

Electric automobiles have increased rapidly in number on the streets of Boston in the last two or three weeks. Most of the vehicles are those operated or leased by the Lead Cab combination there, which operates from the old Cyclorama building as a central station, on upper Tremont St.: but within the last fortnight a number of electric vehicles of the Woods pattern have made their appearance. These are sample vehicles sent on here to be used eventually in opening the agency which was mentioned in The Horseless Age a few weeks ago, and for which negotiations are to be closed, it is expected, this week. These machines are handsome and stylish in appearance, and are rather more elegant as pleasure vehicles than any of the same class of carriages so far introduced in the Boston service by the Electric Vehicle Co., which merely leases carriages and delivery wagons for private use. The Woods vehicles will be sold outright. One of the reasons why the electrics have suddenly appeared to be more numerous is the placing in service of 15 delivery wagons by Houghton & Dutton, who deliver goods on a large scale through the city and suburbs 5 miles out. These wagons are leased from the Lead Cab Co., which took over Houghton & Dutton's old drivers in accordance with its rule to have only its own employees in charge of leased vehicles. The wagons are of the standard pattern, painted yellow and red, like all the store's wagons, and they have been so far making rather better time than the old horse delivery wagons.

They have been expected to cover more ground, however. From the start the firm gave each electric as much territory as a one-horse rig had under the old system, and a little more beside. This made it necessary for the drivers to take long runs out of town, and at first a number of them got into difficulties on account of running out of power when far from a recharging station. This was particularly the case on the northerly side of city, where the Lead Cab Co.'s public vehicles have little call to go. The southerly side of the city, where the Lead Cab business is flourishing, is well provided with recharging stations, but at present the wagons running northward have made arrangements with electric lighting companies in several instances for recharging, and the delays are being overcome.

The Hotel & Railroad News Co. has put on a large electric delivery wagon for its city service in Boston, and Ferguson Bros., bakers, are now using a Clark steam motor wagon for special order work, in addition to the electric wagon for general delivery, which has been in use for a year. On account of the gasoline contained in its tank, and in order to avoid an increase in insurance rates, the wagon is stored by itself in an outlying shed, or else emptied of gasoline every night.

## The De Dion and Bouton Patents.

The Automobile Association, Ltd., dealers in De Dion and other motor vehicles, write the editor of the Motor Car Journal as follows:

Dear Sir.—With reference to the De Dion and Bouton patents, I desire to point out to you that there seems to be some error as to the steps Messrs. De Dion and Bouton have really taken in France to protect their patents, and it may be of interest to your readers if I explained the position. At the last Salon de Cycle you reported that Messrs. De Dion and Bouton have made a seizi, and without an explanation of this term your readers may fall into the error that they have made a seizure. It is nothing of the kind. A seizi in France is nothing more nor less than a slightly more legal form of a solicitor's letter. In other words, Messrs. De Dion and Bouton wrote solicitors' letters to people they alleged had infringed their patents, which infringement, by the way, they put down merely to the four posts on the air-cooled motor. Apart from this, Messrs. De Dion and Bouton have never taken any action against any person or persons, with the exception of one firm, which had gone into liquidation, Messrs. De Dion and Bouton obtaining a judgment on account of action being undefended. Apart from this action, Messrs. De Dion and Bouton have made no movement whatsoever, nor are they likely to do so, against any firm in France.

It might also interest your readers if I mention that the famous trembler, over which many people came to great differences as to its value as a bona fide patent, has now been found, or at least I should say anticipation has been found. It is published in a French book under the name of the trembler Gauthier, which book was published many months previous to the dates of Messrs. De Dion's patents. The design of the trembler Gauthier is given, and it is in every way similar to De Dion's patent, showing as well as the trembler the same cam containing the identical slot. I should be pleased to give any of your readers the name and date of this book, if it interests them. Yours faithfully,

THE AUTOMOBILE ASSOCIATION, LTD.

D. M. Weigel.

The stockholders of the New England Electric Vehicle Transportation Co. are getting down to business. At their first annual meeting, held April 3, they voted to reduce their capital stock from $25,000,000 to $5,000,000 with the shares $10 each instead of $100. We hope to see their example followed in other quarters before long.

## New St. Louis Model.

The new model of the St. Louis Motor Carriage Co., shown herewith, weighs 1,600 lbs. and is fitted with wooden wheels and 3-in. pneumatics. The water tanks, of corrugated copper, are placed in the sides of the body, where there is a free circulation of air and their outline harmonizes with the general design of the vehicle. The price of the new model is $1,250. The company has so many orders in hand for spring delivery that a night force will be added at once.

NEW MODEL OF ST. LOUIS MOTOR CARRIAGE CO.

# Evolution of the Motor Vehicle as by Patents.

PART III.—THE TRANSMISSION GEAR.

(Continued.)

By Leonard Huntress Dyer.

The art of driving and steering two wheels, as well as the driving and steering of all the wheels of a tetracycle, meets with some serious obstacles. Not only must the several wheels be properly driven, but they must be capable of being steered.

If the propelling motor be carried by the supporting axles and be turned or twisted about the king-bolt in steering, the transmitting media can be both rigid and simple.

An early American patent, which shows this idea, is that of J. B. McKinley, No. 111,761, Feb. 14, 1871. In this patent a single wheel is driven directly by a vertically mounted engine on a turn-table. A suitable coupling for the steam pipe permits the turn-table being turned without affecting the operation of the engine.

Another patent, viz., to J. H. Bailey, No. 26,466, Dec. 20, 1859, uses a single steering wheel, which is also driven. Bevel wheels are secured to each side of it, which connect to bevel pinions mounted upon vertical axles. The horizontal axle is driven by a vertical axle, which passes through the king bolt, and is driven by rope gearing. The front wheel is mounted in a yoke.

The patent of J. Robingson, No. 15,820, of Sept. 30, 1856, illustrates a long steering axle driven by a chain wheel carried by a ball and socket joint on the countershaft.

In G. Bradley's patent, No. 16,044, of Nov. 11, 1856, a driving and steering forecarriage is shown. The wheels, two in number, are keyed to the revolving axle, which is mounted in a yoke. A bevel gear slightly to one side of the center line meshes with a bevel pinion carried upon a vertical shaft, which passes through a hollow king bolt. The upper extremity of the shaft carries a bevel gear, which engages with a bevel pinion on a horizontal shaft directly connected to the engine. The engine shaft and the driven shaft are parallel.

An ingenious device is illustrated in the patent of Lewis H. Hake, No. 62,264, Feb. 19, 1867. The four wheels are all drivers, two of them being steerers on a long axle. The engine is on springs and drives the axle by a horizontal shaft and bevel gears. Fig. 5 shows how the front wheels act both as steerers and drivers. The view is supposed to be partly in section. The axle a turns in bearings supported upon an auxiliary frame, b, which is connected to the vehicle body c by springs d and a king bolt e. The gear f is connected to the operating motor and drives the axle through the agency of a horizontal shaft, g, and bevel gears, h. The shaft is provided with the universal joints i i, and the telescopic section j to allow the axle a and frame b to be turned upon the king bolt, and yet to be always in connection with and rotated by the driving motor.

The patent of Thomas, Craig, Craig and Hathaway, No. 115,786, June 6, 1871, illustrates a device that might well be employed at the present day. The vehicle is driven by means of the steering wheel. Fig. 6 is a front view, partly in section, of the forecarriage. The axle a turns within bearings carried by a fifth wheel connected to the springs b, which support the body c. The usual bevel gears d connect the axle to a vertical shaft e. The latter is provided with a universal joint f

Fig 5

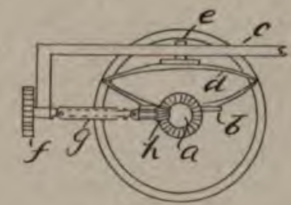


Fig 6

Fig 6a

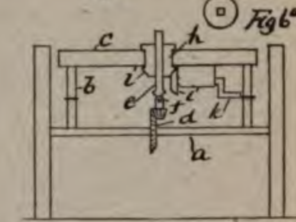


Fig 7

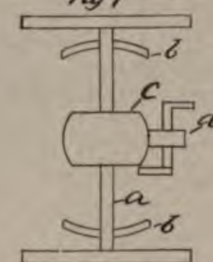
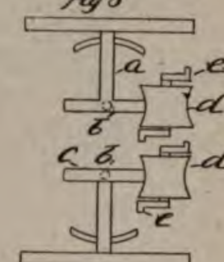


Fig 8



and a squared upper portion, which passes through a rectangular opening g in the nut h, as is shown in Fig. 6a. The nut h is provided, integrally upon its lower flange, with a bevel gear, i, which engages with a pinion, j, carried by the horizontal engine shaft k. The latter, it will be seen, is above the springs, yet the connection to the wheels is sufficiently flexible to allow of the body oscillating independently of the wheels.

The French inventors, Messrs. Bocca and Serre, obtained a patent in Germany, Jan. 17, 1881, No. 12,475, for an ingenious but probably impracticable driving device for all the four wheels. This is illustrated in Fig. 7, which is a top view of the driving mechanism. Each of the axles a is mounted in bearings upon the fifth wheel b and carries at its center a globe gear, c. The latter engages with a concave pinion, d, mounted upon the countershaft. The teeth of the two gears are supposed to be so cut as to allow the gears to mesh irrespective of the parallelism of the two shafts.

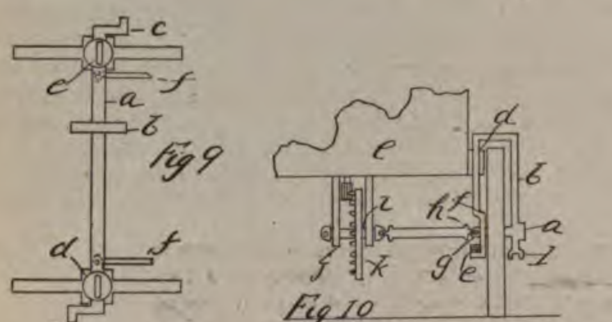
A modification, wherein the steering and driving wheels are carried upon short, independently pivoted axles, is illustrated in Selby's British patent, No. 3,211, of Dec. 21, 1861. This device is shown in Fig. 8, which indicates how the two wheels are independently driven and steered. Each wheel is mounted upon a short axle or stub, a, pivoted at b. A narrow-faced globe gear, c, engages with a concave gear, d, carried by the short countershaft e. Each wheel is independently driven by a separate engine. Suitable means are provided to direct the axles and guide the carriage.

C. B. Monnot's American patent, No. 197,485, Nov. 27, 1877, shows the steering wheels driven from a long axle. The engine is fixed and the axle journaled in the turn-table. A bevel gear is provided on the axle. A bevel pinion and bevel gear, connected together upon the vertical shaft, engage respectively with the bevel gear on the axle and a bevel pinion on the engine shaft.

The American patent of R. H. Leky, No. 42,203, Aug. 5, 1864, describes a complicated device. The driving wheels, which are also the steering wheels, are mounted upon vertical pivots adjacent to the hubs thereof. A pinion carrying a bevel pinion upon its lower face is mounted concentrically within the pivot of each wheel. The bevel pinion engages

with a bevel gear formed upon the hub of the wheel and is attached to the spur pinion. It is driven by a horizontal plane gear carried upon the vehicle frame. This plane gear is driven by the engine shaft by means of the bevel gear and bevel pinion. The engine shaft is parallel to the wheel supporting shaft.

The patent of E. P. Cowles, No. 154,846, Sept. 8, 1874, is illustrated in Fig. 9, which is a top view of one of the axles; the other axle is nearly identical. The axle a turns on bearings and is driven by a gear, b. Cranks are provided at c for the attachment of connecting rods to the second axle. The wheels are mounted upon gimbal joints, d, provided with locking keys, e, for giving positive rotative movement to the wheels. Arms and levers, f, are provided for steering. It will be noticed that the four wheels are steerers as well as drivers.




A modification of this device, wherein the countershaft is carried within gimbal bearings and drives the main axles by means of spur gears, is illustrated in the British patent of J. Espey, No. 2,240, June 1, 1880. The bogie axles are driven from a shaft which retains a constant positive relation to the engine by means of a universal joint, so as to allow the bogie axles to assume various degrees of obliquity to the engine when running around curves. The driving shaft passes freely through the center of a toothed driving wheel, to which it is connected by a universal joint consisting of suitable crank pins, carried by the driving shaft, and sliding longitudinally through gimbal joints, which work in sockets that are free to slide radially in a slot in the gear wheel. The driving wheel revolves between the cheek pieces carried by the turning frame, or fifth wheel, and gears with suitable spur gear wheels on the bogie axles. The inventor describes wherein the arrangement may be inverted by holding the wheel in stationary cheek pieces and driving it from the engine, the bogie axle passing through the center of the wheel and being driven by a universal joint, as described above. Belts or pitch chains may be substituted for the toothed gearing, as will be evident.

W. H. Milliken's patent, No. 163,681, May 25, 1875, is of some interest. The steering wheels are driven from a fixed engine mounted within an elastically supported body. The device is illustrated in Fig. 10, which is a sectional view through one of the wheels; the other three are identical. The axle a is journaled in a yoke, b, supported upon the spring c and guided by the sleeve d, attached to the body e. The yoke is provided with an offset, f, within which is the pivot of the universal joint g. A short shaft, h, connects the joint to a central shaft, i, mounted in bearings j, and carrying a crown wheel, k. The four wheels are simultaneously guided by rods, pivoted to the ears l.

A modification is shown in J. Braby's British patent of March 9, 1881, No. 1,009. This device uses one wheel, which is a combined steerer and driver; the other two are simply trailers. The driver is supported upon an axle, interrupted near one side of the frame, where is located a universal joint. The axle is continued and ends in a spur gear, driven from a countershaft and a second gear or pinion. The axle is mounted in a box at its free end. This box is carried in ways, analogous to a fifth wheel. A worm and rack gear is used to move the bearing box over the ways and thus steer the vehicle. The pivoting point of the axle is the universal joint.

## Advent of the Agent.

The Locomobile Co. of America is strongly represented in central and western New York, having appointed two special agents, the Syracuse Automobile Co., 215 West Water St., Syracuse, and the Rochester Automobile Co., East Main St., Rochester. C. Arthur Benjamin, formerly identified with the bicycle trade, is the proprietor of the former, and Joseph J. Mandery, likewise formerly interested in the bicycle trade, is the owner of the latter. Mr. Benjamin has the exclusive agency in the counties of Onondaga, Herkimer, Chenango, Cayuga, Jefferson, St. Lawrence, Tompkins, Oneida, Madison, Cortland, Oswego, Lewis, Broome and Franklin. Mr. Mandery has sole jurisdiction over about the same number of western counties. Both general agents are appointing sub-agents in the various counties under their care.

The Syracuse company is incorporated, with $10,000 capital, all paid in, Mr. Benjamin being the chief stockholder. The store occupied, 100 x 40 ft., is located on an asphalted street in the center of the city. The store of the Rochester company is somewhat larger, while underneath is a basement for the storage, care and repair of vehicles.

Both agencies report more orders than the factory can supply.

A correspondent of the Motor Car Journal writes that he has accomplished a run of 221 miles, viz., from Edinburgh to Selby, on a 6 h.p. Daimler car without once stopping. He says: "I left Edinburgh at 9 p. m. on Wednesday night, reaching Selby at 2 p. m. on Thursday, thus running 16 hours consecutively. The car consumed 11 gals. of petrol and 1 gal. of water. Had it not been for wind and rain I see no reason why the car should not have run nearly as far again, as I had 9 gals. of oil unused, and as both the motor and all the bearings were perfectly cool, although the latter are only fitted with the standard small-size lubricators."

## The Thresher Electric Vehicles.

Realizing the increasing demand for an electric vehicle that would in efficiency, durability and ease of manipulation meet the severe requirements demanded of the automobile, the Thresher Electric Co., Dayton, O., well-known manufacturers of electric motors, gave their attention to the designing of such a vehicle. The result of their tests and experiments has been the production of the wagon shown in our illustration, which has been put through most severe tests, with results stated to surpass the most sanguine expectations of its inventors.

The illustration represents a four-passenger brake, showing it as it was loaded for its first run, carrying 1,500 lbs. of passenger weight. This abnormal load, it is said, was handled with the greatest ease, there being no perceptible additional effort over handling a normal load. The vehicle complete, without passengers, weighs 2,200 lbs.

The body, manufactured by Morris Woodhull, Dayton, O., is strongly built and has the appearance of being constructed especially as an automobile. The wheels are ball bearing, the tires being 2 in. solid rubber. Steering is done by the front wheels, which are pivoted on the axle.

The frame is of a new type, the weight being supported at three points. The front axle is pivoted, giving great flexibility to the frame, and adjusting itself to the inequalities of the road, so that it is possible to make sharp turns at full speed without the least tendency to tilt. The springs being mounted upon this rigid frame, keep the body of the wagon in its normal position.

The electrical equipment consists of two 1½ h.p. motors, geared independently to the rear wheels. These motors, though of special design for this particular class of work, are upon the lines of the inclosed motor which has been manufactured by the Thresher Electric Co. for years, and are covered by very broad patents. The motor case, while entirely protecting the working parts, is so designed as to afford ease of access for inspection and renewal of brushes. They are pivoted upon the rear axle and flexibly supported upon the frame, so as to relieve the jar.

By means of a carefully adjusted system of control, four speeds are attained, either backward or forward—3, 7, 10 and 15 miles an hour. This variation in speed is attained by a special method of control without introducing external resistance nor too great manipulation of the batteries, making an extremely efficient and simple method of control.

The battery is a novel feature of the vehicle, consisting of 40 cells of the Faure type arranged in four banks and having a capacity of 120 ampere hours. Each cell weighs complete but 20 lbs.

With this extremely light equipment the inventors state that the vehicle has been driven over 50 miles over hilly country roads on one charge, although in its construction no attempt has been made to produce a racing vehicle. All classes of roads have been gone over and the steepest hills surmounted.

In addition to the type of vehicle shown, the Thresher Electric Co. are manufacturing a complete line of vehicles, including runabouts, stanhopes, broughams and all classes of light and heavy delivery wagons, to meet the demand of all users. The complete equipment is produced in the shops of the company, who are experienced and reliable manufacturers.

THE THRESHER ELECTRIC CARRIAGE.

## An Important Question.

West Philadelphia, Pa., April 3.

Editor Horseless Age:

To what temperature will air be raised by compressing it from atmospheric at 60 degs. F. to 90 lbs.; also from atmospheric to 120 lbs.? What will be the relative volume of the air in each case, calling the volume of the free air 1?

What is the limit of temperature to which a mixture of air and gasoline vapor, 8 to 1, can be subjected before ignition takes place?

GEORGE F. DILLIG.

As our correspondent's first questions touch upon ground a clear knowledge of which is indispensable to any designer of gas engines, and as the information which would aid in settling these and similar questions is not always immediately accessible, we think that they deserve a more extended answer than usual.

Assuming that the air is compressed without heating or cooling from external sources, there are two processes involved in calculating its temperature. The general formula for any gas is

$$PV = RT$$

in which P is its absolute pressure, V its volume, R a constant depending on the nature of the gas, and T its temperature, measured from absolute zero (— 460 degs. F.). This formula expresses the relation between the pressure, volume and temperature of a given weight of the gas, under any conditions of heating or cooling or change of volume or pressure. So long as the given sample of gas is pure, and its weight is unchanged; so long, also, as it is not compressed or cooled too close to the point of liquefaction, the formula holds good.

But this formula contains three variables, only one of which—i. e., P—is known in the present case, and it is therefore necessary to ascertain the value of V by other means. Now, if a gas is compressed without addition or subtraction of heat, its temperature rising merely from its own compression, or if it be expanded in like manner, its pressure and volume bear the relation expressed in the well-known adiabatic curve, whose formula is

$$PV^{\gamma} = C$$

which means that the product obtained by multiplying P into a certain fractional power of V is a constant. The value of this exponent $\gamma$ is the ratio between the specific heats at constant pressure and at constant volume of the gas in question. For most of the ordinary gases it is between 1.26 (for carbon dioxide) and 1.41 (for hydrogen, nitrogen and air under ordinary conditions). For dry air it is 1.40.

By this formula, therefore, with the aid of a table of logarithms, we can calculate the volume resulting from the compression or expansion of our air to any degree. As an illustration of its use we will work it out for the specific cases chosen by our correspondent, assuming that the pressures named (90 and 120 lbs.) are absolute or measured above a vacuum.

If we take 1.4 as a sufficiently accurate value for the exponent, we have

$$PV^{1.4} = C = P_1 V_1^{1.4}$$

Taking $P = 14.7$, $V = 1$, and $P_1 = 90$, we have

$$\begin{aligned} \log V &= 0 \\ \log V^{1.4} &= 0 \\ \text{" } P &= \underline{1.1673} \\ \text{" } PV^{1.4} &= 1.1673 = \log C. \end{aligned}$$

$$V_1^{1.4} = \frac{C}{P_1}$$

$$\log V_1^{1.4} = \log C - \log P_1.$$

$$\begin{aligned} & \quad 1.1673 \\ \log P_1 &= \underline{1.9542} \\ \text{" } V_1^{1.4} &= \bar{1}.2131 = 0.2121 - 1 \\ &= 0\ 6131 - 1.4 \end{aligned}$$

Dividing both quantities by 1.4

$$\log V_1 = 0.4385 - 1 = \bar{1}.\ 4385$$

Hence $V_1 = 0.274$ at 90 lbs. pressure.

By a similar process we find that $V_1 = 0.223$ at 120 lbs. pressure; and we are now ready to return to our general formula.

Putting $$\frac{PV}{T} = R$$

and substituting the known values before the air is compressed, we have (remembering that T is absolute)

$$\frac{14.7 \times 1}{460 + 60} = R = 0.0283$$

Putting $$T_1 = \frac{P_1 V_1}{R}$$

and substituting the known values, we have, when $P_1 = 90$ lbs.,

$$T_1 = 874^\circ - 460^\circ = 414^\circ$$

and when $P_1 = 120$ lbs.,

$$T_1 = 947^\circ - 460^\circ = 487^\circ$$

Our readers will of course understand that these are the results obtained with pure air under ideal conditions. An admixture of gasoline vapor will make a slight though not important difference, while the heat of the cylinder walls will modify the results considerably. In practice V can never be made quite as small as these calculations would call for.

Regarding our correspondent's last question, it should be remembered that the temperature of the mixture is only one of the factors determining its spontaneous ignition. The other, which can never be neglected, is its pressure. The best practical answer to the question is to say that a rich mixture is liable to explode spontaneously at any pressure above 100 lbs. gauge. Its ignition will usually be caused, however, not by its own heat, but by the heat of the hottest part of the igniter or other inwardly projecting part, which does not get the benefit of the outer cooling. H. L. T.



## The Bramwell Jacketless Oil Motor.

Clarence C. Bramwell, Hyde Park, Mass., has been experimenting for several years to produce a reliable jacketless motor of sufficient power to propel a light carriage. The editor of The Horseless Age was recently invited to see the result of these experiments at the factory of the American Tool & Machine Co., Hyde Park.

The motor, which weighs 180 lbs., fly wheel, silencer and magneto included, works on the Otto cycle, is 30 in. long,

18½ in. high and 15 in. wide, and is calculated to deliver about 2½-h.p. when mounted on a vehicle. Through the manipulation of the mixture and the sparker the speed may be varied from 180 to 1,500 revolutions.

A particularly interesting feature of this motor is the valves, especially the exhaust valve, which is one of the chief difficulties in an unjacketed motor. All the valves have large bearing surfaces, and the exhaust valve is so constructed as not to be injuriously affected by the heat. The stem is elongated, bringing the spring away from the heat and preventing loss of its temper. This valve can be taken off, seat and all, in less than five minutes, and if an extra one is taken along in the tool box it can easily be substituted on the road and the old one can be reground if desired.

The inlet valve is also easily got at. It can be taken out, seat included, in two minutes, giving access to the spark mechanism, which is of the primary or low tension kind.

The construction of the sparking mechanism is such that there are no joints within the motor. All are on the outside away from the heat. Adjustment of the sparking apparatus is complete in all directions.

The cylinder is 4⅛ in. and the stroke 5 in. Each cylinder is bored out twice. First a roughing cut is made; then it is put on an arbor and the outside is turned off, and finally put on a center lathe and a light cut taken out with a boring bar, carrying the tool to the exact standard size. In this manner is secured that perfect accuracy which is necessary for the proper working of an unjacketed motor.

The piston rings are made up in stock and are formed to hardened steel gauges, as also are the pistons, connecting rods, bushings, crank cams and cam shafts.

The cam shaft is made in one forging with the cam; hence the novice cannot make a mistake in assembling these parts and the cam cannot work loose, as it would be very apt to if it were separate, because of the constant strain of opening the exhaust valve. This cam shaft is driven from the engine shaft by means of two speed gears, one of which is made of fibroid. These gears, together with the cam shaft, exhaust valve levers and sparking cam, are all contained within a dust-proof casing, which also incloses one of the main bearings of the motor, the other being completely covered by the fly wheel.

The gas is not burned in the cylinder itself, but in a ribbed copper combustion chamber, so that the expansion and contraction of the heated parts may not affect the working of the piston. In fact, Mr. Bramwell states that the cylinder and piston never get hotter than in a jacketed steam engine.

The crank is cut out of the solid steel forging, made to a gauge in every particular as to length, diameter, width of cheeks and throw. The crank shaft is finished all over, obviating the possibility of flaws. To secure lightness, the crank is made hollow. The wrist is lubricated through one end of the crank shaft. The connecting rod is fitted with large phosphor bronze bushings, with a new device to obtain perfect adjustment. The crank cases are made in cast iron or aluminum, as desired, the latter saving 20 lbs. in weight and avoiding rust. The crank shaft runs in phosphor bronze bushings, made exactly to standard size and easily withdrawn from the crank case when worn.

The main oil cups are cast in the frame, so that there is no possibility of losing them on the road. To avoid the trouble usually experienced in the oiling of high-speed motors, the designer has put on large oil cups, running from a week to a month with one oiling. All oil cups are accessible without disturbing any part of the machine.

The spark is produced by a Holtzer-Cabot magneto, which, although geared to only three times the speed of the motor, thus securing long life and freedom from heating, gives a spark to start the motor without the use of batteries. The magneto is carried on the main frame and is operated from the fly wheel by a spring belt. As the spark coil is also similarly placed, there is only one wire to look after, one pole of the magneto being grounded to the case, and this one wire cannot be wrongly connected, whether attached at the top or the bottom of the coil. This is a great advantage to the amateur.

The mixture is derived from gasoline carried in a tank, which is also a fixture with the main frame of the motor. The oil flows drop by drop into a mixing valve of simple construction, and passes from there to the combustion chamber. As this valve is placed near the inlet valve, there is no body of gas on hand to endanger the carbureter. The muffler, original in design, and made of composition metal, weighs 8 lbs. and is unaffected by expansion and contraction or rust. It contains no fillings and is of greater area throughout than the exhaust pipe, thus preventing all back pressure.

Every part of this motor is made in special jigs on the duplicate part system and can be cheaply and easily replaced in the event of breakage or wear.

The American Tool & Machine Co., whose office is at 109 Beach St., Boston, Mass., will build the unjacketed Bramwell motors and also jacketed multi-cylinder vehicle motors and marine motors designed by Mr. Bramwell.

## COMMUNICATIONS.

## *LESSONS of the ROAD*

Buffalo, March 28.

Editor Horseless Age:

I am using a small storage battery of two cells to furnish current for sparking the motor, and I like it because it is small and light compared to the six-cell primary formerly used, and there is no trouble with the sloppy solution. A voltmeter shows 4 volts in the storage, and it will give a good spark at 2 volts.

The primary usually registers 5½ volts and will put 4 volts into the storage as I now connect them, when the carriage is not in use. Here I am a bit lame and wish some kind reader would give me a tip. This is my method: To connect the primary and storage, positive to positive and negative to negative, and include in the circuit on the negative side two of the long 10-in. spark coils used in sparking. My reason is that the resistance of the two coils will approximate the resistance used when running the motor. And in practice I find the storage is charged at a safe rate, for I have not noted any ill effect as yet, and the storage battery has served me through the summer and so far this winter.

I would like to get 5 or 6 volts in the storage, if possible.

The carriage is fitted with a single lever at the right which controls the application of power. When in its central position there is no connection with the motor whatever. A forward movement starts the carriage slowly, more forward movement increases the speed, and so on to the limit. A backward movement decreases the speed until the central position is reached, and further backward motion reverses

the carriage, or backs up. This single movement makes an effective brake to hold the carriage on a hill or to check its momentum. Any speed may be used within its limits. You are not confined to three or four fixed speeds, but can shade down or up, as it were, by a natural motion.

The simplicity and convenience of this arrangement have been a comfort to me, and I appreciate it more after trying others with more complications. A recent drive in a French motor carriage, one of the best make, will serve as an instance. The driver had three hand levers, three foot levers, two hand wheels and a bell to think of and manipulate, and it kept him occupied.

The steering in use at the present time has a 4-in. crank upon an upright shaft in the center of the seat under the driver's left hand. One half turn of this lever steers the carriage around the ordinary street corner. It is safe to let go at any time, as it remains where you drop it, but having been accustomed to the simple lever steering during the earlier summer months, this seems slow, and I do not feel quite reconciled to the change yet, although I can appreciate the locking principle.

The lever steering formerly used was geared down, as we say, three to one—that is, the lever favored the hand over the wheels to that extent (a decided advantage, I found, on rough roads). Still it was always necessary to be watchful and never safe to let go for an instant.

I recall two occasions on which the quickness of this lever steering saved me from accident. Once, when approaching a trolley crossing, two cars shot into view from behind the buildings, moving in opposite directions at high speed. A quick turn put the carriage parallel with the nearest car and raised the hair on my head—at least, I felt that way, for I had a lady and her little boy on the seat with me at the time. Once, in turning from a paved street into a country lane, a deep hole, not noticed, startled me into turning quickly toward a ditch used for drainage; then a second turn to avoid that steered between the difficulties with a narrow margin.

Often have such things shown the value of quick steering, and I am inclined to prefer the lever to the wheel or crank, as we have it, or as seen in the French carriage mentioned before. If we could combine a lock principle with the ordinary lever it would seem to me perfection.

My driving impresses on me the need of simple and natural motions in controlling the carriage. Then in emergencies one is more likely to escape trouble. I think that French carriage would have been smashed in either of the instances mentioned, while the driver was selecting one of those six levers and deciding whether to pull or push it.

Replying to the Editor's query regarding the grade of gasoline used, my first letter mentioned the fact that I bought the ordinary stove gasoline, supposed to test 74 degs., but I have used grades as poor as 59 degs. successfully.

E. N. B.

## An Inoperative Device.

Westboro, Mass., April 6.

Editor Horseless Age:

In your issue of March 7 you published an article on page 20, entitled "New Safety Device for Steam Carriages." In the description of the device you say, "Should the water get abnormally low, so as to expose the end of the sleeve, the rise in temperature will be sufficient, before the water can get lower, to melt the plug," etc. I understand that water under pressure has the same temperature as the steam with which it is in contact. In this case I do not see how it would be possible to use a plug which would fuse under the stated conditions (water remaining in the boiler) and yet not fuse under operating conditions. Will you kindly explain this point and greatly oblige? Yours truly,

T. F. AHERN,
Locomobile Co., Westboro, Mass.

[Obviously, unless the fusible metal be exposed to the flame instead of to the steam merely, it will not melt till the water is all gone, and then it will be too late to save the boiler. If the annular space between the pipe and the sleeve were made larger, so as to admit the flame freely, the contrivance might be made to work.—H. L. T.]

## As to Regulation.

Duncan Falls, N. Y., April 2.

Editor Horseless Age:

I am designing a motor carriage to be run by variable speed gasoline engine, 500 to 1,500 revolutions per minute. I am perplexed to know how to control the speed and power of the motor.

S. M. HOWELL.

On tricycles this is usually done by shifting the igniter, so that ignition takes place after the crank has passed the center. On carriages it may be done by throttling the mixture, by using a hit-and-miss governor spring, by holding the exhaust valve open, by cutting off the fuel supply, and others.

You will do well to investigate the gas engine pretty thoroughly before attempting to "design" one.

## Induction Coil for 2 H. P. Motor.

New York, March 25.

Editor Horseless Age:

Will you kindly publish in the columns of your paper the size of an induction coil required for a 2-h.p. gasoline motor? What is the size of the spark in air, and what should the distance between points be in the motor?

T. FRANK KOHLER.

An induction coil for a "jump spark" for lighting a gas engine (any size) may be 8 or 9 in. long, with outside coils about 3½ in. in diameter. It should be sufficiently well insulated and constructed to give a spark in air from .25 to .5 in. long.

The distance between points in the cylinder may be about 1-32 in. A thick short spark is the best for lighting, and there is less danger of short circuiting with the points close together.

E. J. STODDARD.

## The De Dion Gears.

Boston, Mass., April 3.

Editor Horseless Age:

Referring to the letter from "A Constant Reader" in your issue of Feb. 28, as to how to lessen the noise made by the gears of the De Dion tricycle, if he uses bronze gears, properly meshed and kept running in thick oil, with a gear case to cover them so as to keep the dirt out, he will find that they will make no more noise than an electric carriage.

KENNETH A. SKINNER.

# OUR FOREIGN EXCHANGES.

## The De Dion-Bouton Light Carriage.

The light carriage lately brought out by De Dion, Bouton & Co., and illustrated in La France Automobile, possesses several features in which it differs from the usual practice on this side. The frame, instead of being rigid with the rear axle, is made rigid with the body, and the springs are interposed between the axles and the frame. This involves several special features of construction, which will be noted from the following description:

The general appearance of the vehicle is shown in the photograph, and Figs. 1 and 2 show in outline the side elevation and plan, the latter with the body removed. In these figures the rear springs are shown at k m, and the rear bearings, which attach to the lower springs m, at u.

The forward axle is connected to forward springs, g, which are connected at h h to the forward ends of the reach tubes a and at their rear ends support a semi-elliptical transverse spring, i, which bears a portion of the carriage weight at its center.

As will be seen from Fig. 2, the reaches a a are connected by transverse tubing at b, c, d and e, and the frame is thus made as rigid as possible.

The motor is of the ordinary De Dion-Bouton vertical type, with water circulation, and is of 3 b.h.p. It is shown at n, in Fig. 2, and is suspended from the transverse tubes d and e. Its shaft is prolonged into the gear case r, and may be seen at t in the same figure.

The speed change gear is shown in section in Figs. 3 and 4. In these t is a prolongation of the motor shaft, and it carries the pinions a and b, of different sizes, which are in constant engagement with the gears running loose on the secondary shaft u. These gears carry the clutch shells c c, by which their motion is transmitted to u through the clutches. In Fig. 4 m m is integral with the secondary shaft u and it is bored throughout its length to contain an auxiliary movable rod shown in the center. This rod is shown to form a sort of rack which engages the pinions p p, whose axes are formed in the shape of screws, with right and left hand threads, as shown. The clamps s s are the transmitting members of the clutches, and they are actuated by the specially formed nuts e e, which receive the threads of the pinion studs, and are approached or spread apart by the rotation of the pinions when the latter are revolved by the axial movement of the central rod or rack. In Fig. 3 the rack is shown in its neutral position, in which both clutches are disengaged, and the running of the motor is not transmitted to the secondary shaft; and the arrangement is such that the movement of the rack to the right or left, as indicated by the arrows, engages one clutch and relaxes the other still further. From the shaft u the motion is transmitted through the pinion and the gear y, shown in Fig. 2. There are thus two forward speeds, which are further supplemented by changing the time of ignition in the same manner as on the tricycle made by the same firm.

The starting device consists of a sprocket wheel, chain and ratchet; it was described in The Horseless Age of April 4 and need not be enlarged upon here. The starting crank is shown at W (Fig. 1) and the ratchet is on the motor shaft t.

Reversal of direction is effected by the means of the reverse gear, shown at z, in Fig. 2, and in section in Fig. 5. In Fig. 5 a is a bevel gear mounted on the squared end of the shaft u, and engaging two bevel pinions c d, mounted in the

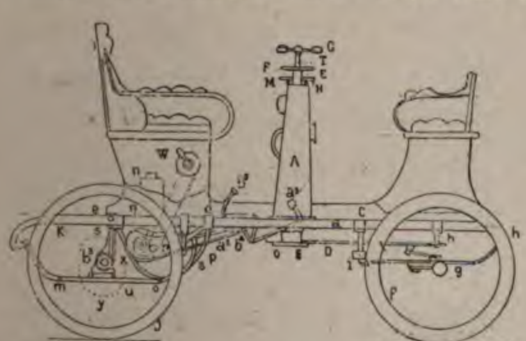


FIG. 1.

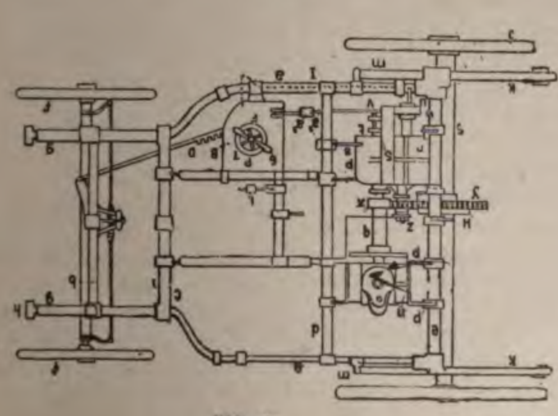


FIG. 2.

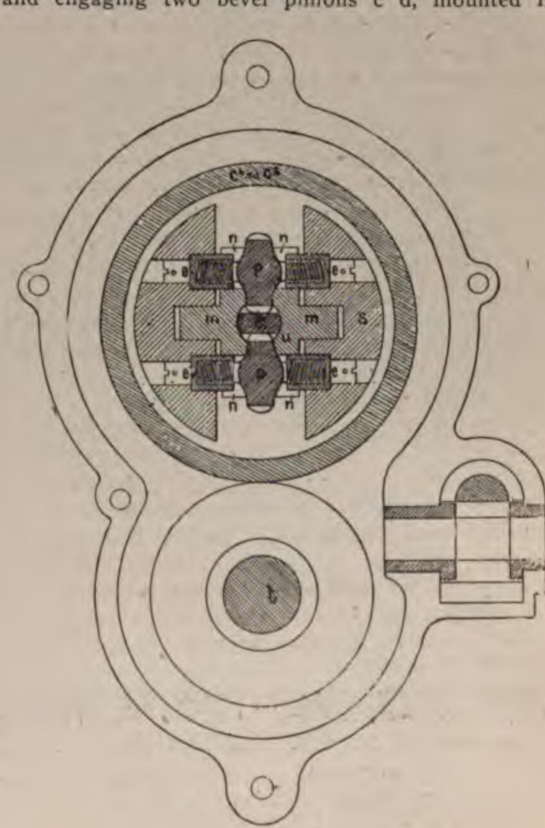


FIG. 4.

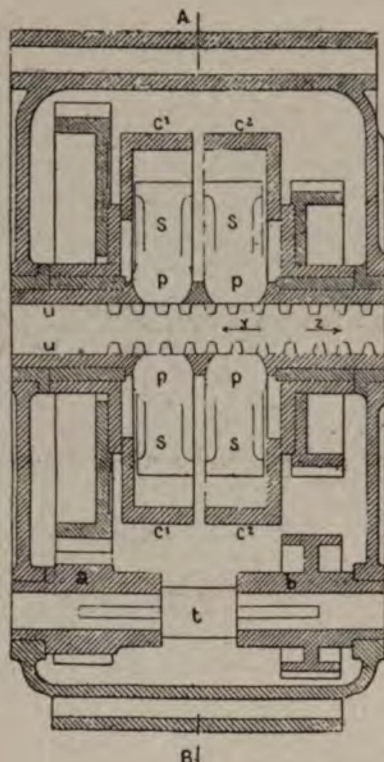


FIG. 3.

DE DION AND BOUTON LIGHT CARRIAGE.

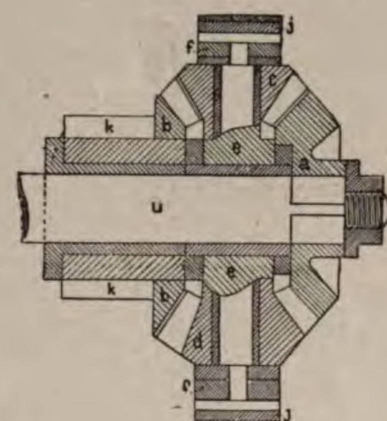


FIG. 5.

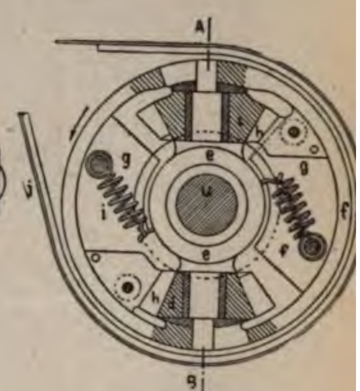


FIG. 6.

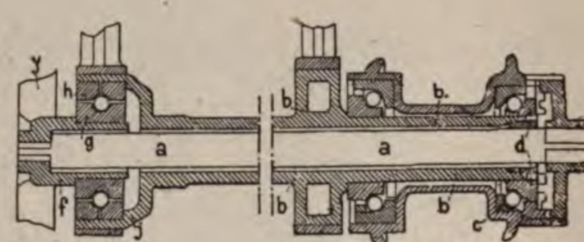


FIG. 7.

drum f. The bevel gear b, which engages these pinions, is fast to the pinion k, which engages the gear y (Fig. 2). Fig. 6 shows a section through the bevel pinions c d. These are normally locked by teeth, h h, mounted on flat segments, g g, and drawn into engagement by the springs shown. In this condition the rotation of the shaft u is transmitted without change of the pinion k. If, however, the brake band be applied on f, the teeth h h, which are each formed like a single gear tooth, will be automatically thrown out of engagement; and the drum f being now stationary, the direction of rotation of k will be reversed.

The rear axle is divided as usual with the differential at H, and it has the special feature of being entirely inclosed by the fixed tube b b (Fig. 7), which is joined to the frame and carries the ball bearings for the wheels at its outer ends. The axle a terminates in a cap, n (Fig. 7), which connects with the hub of the wheel at its circumference.

There are two brakes, one on the extension of the secondary shaft u outside of the gear case, and controlled by the pedal $a^3$ (Fig. 1.). The second brake is on the differential drum, and is controlled by the pedal $b^3$ (Fig. 1).

Steering is effected through a rather complicated system of links and levers, whose object is to permit relative motion between the front axle and the body. A small rotary pump assists the circulation of the cooling water from the tank under the front seat to the motor in the back. A radiating device for cooling the water is added.



## The Serpollet Steam Motor.

In our issue of January, 1899, we illustrated the Serpollet four-cylinder motor. A slightly modified design with two cylinders was lately described in the Automotor Journal, from which we take the following:

The motor is designed for use with highly superheated steam, the temperature of which may be from 400 degs. C. to 500 degs. C.; for this it is necessary to dispense entirely with oil lubricants and packings. The motor consists of two horizontal cylinders arranged opposite each other. These cylinders are single-acting and open into a crank chamber, through which passes the main shaft; the connecting rods are each joined directly to the bottom of the hollow piston.

Referring to the drawings, Fig. 1 is a half side elevation and half longitudinal section of a motor having two cylinders arranged opposite each other.

Figs. 2 and 3 are plan and elevation of the same. Fig. 4 is an elevation and Fig. 5 an end view of the distributing cam.

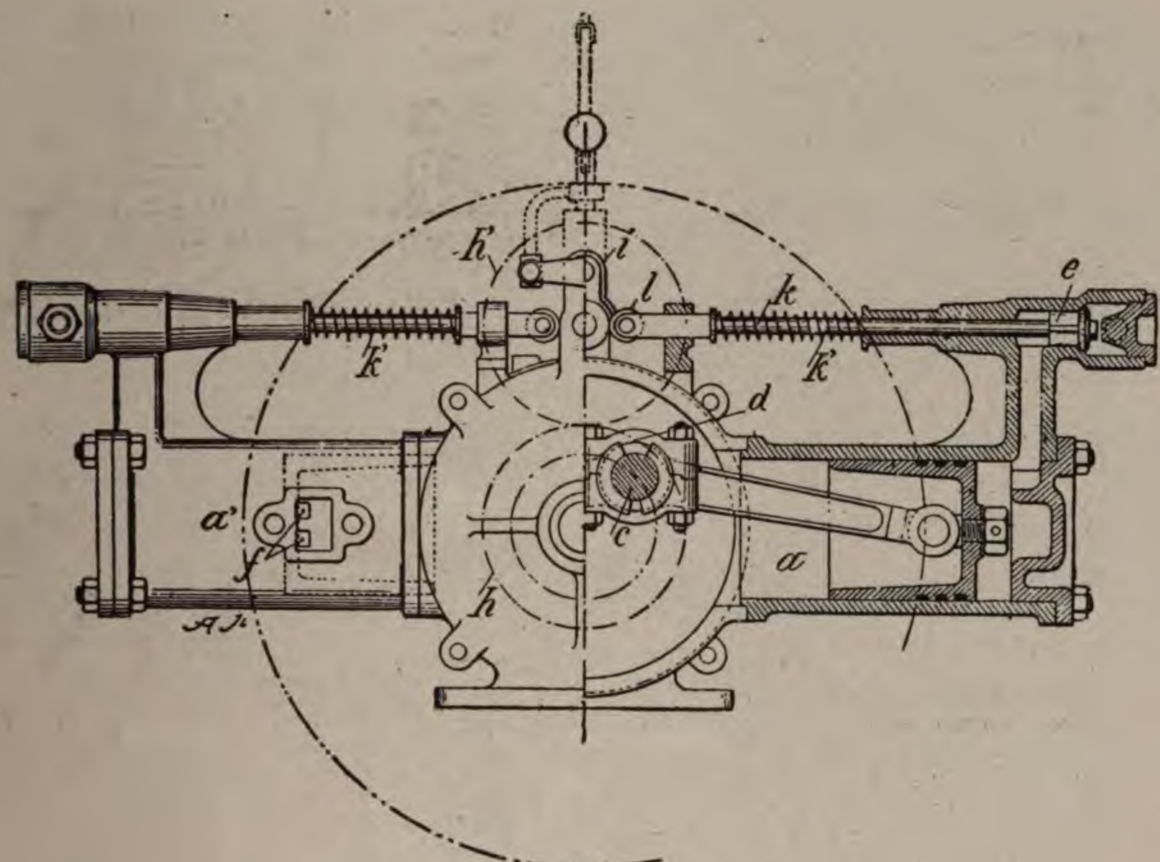



FIG. 1.

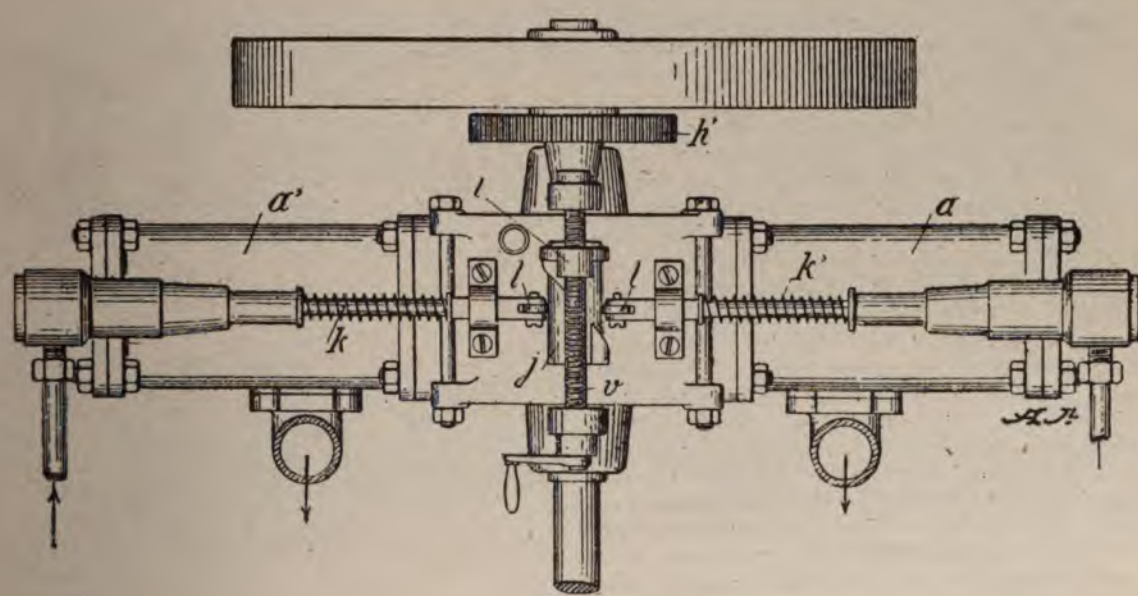



FIG. 2.

The two single-acting cylinders a a' (Figs. 1 to 6) are mounted in line with and facing each other on the frame b, having the general form of a cylindrical box. The pistons are recessed, and have a considerable length relatively to their diameter, which allows of jointing the connecting rods directly thereto, and dispensing with the piston rod, its stuffing box and the slides. The two connecting rods have their heads cut away somewhat in the form of a crescent, in such a manner as to be capable of being both supported in one and the same plane of rotation by means of a common crank pin, c. As

they only work in compression the cap of the end bearing is superfluous. However, for the purpose of avoiding any possible derangement, there are provided two collars, d, which embrace the shoulders of the heads of the connecting rods and keep them constantly up against the crank pin.

The steam enters the cylinders through the outer end of each on the opening of the corresponding valve e, which is operated by means of mechanism described further on. When each piston has arrived at the end of its power stroke it uncovers the orifices f which are formed in the wall of the cylinder and through which the fluid exhausts. The cylinder, however, remains full of the expanded steam at a pressure which may be slightly above that of the atmosphere. This steam, being imprisoned on the return stroke of the piston, is compressed up to the end of the stroke, without the liability that the compression will exceed the pressure in the boiler.

If the compression in the cylinders should exceed the pressure in the generator, the valve e will open and allow the compressed steam to return into the supply pipe, whence it will return afterwards into the cylinder at the commencement of the next power stroke.

It will be seen that this faculty of limiting the pressure in the cylinder to an extent practically equal to the pressure existing in the boiler allows of doing away with the dead spaces and thus effects a considerable saving in steam.

The mechanism of the distributing gear comprises a small shaft, g, parallel to the engine shaft, and rotated by the latter by means of a pair of toothed wheels, h h'. This small shaft carries a cylindrical cam, j, which is adapted to slide along a feather, and is thus capable of moving longitudinally when it is actuated by the nut i, which is provided with a forked tail embracing the circular groove formed in the end of the cam. This nut is mounted on a screw, v, parallel to the axis of the cam, and moves when the screw v, which is held between two stops, is turned either by hand or by a governor. In its rotary movement the cam j moves successively, by means of one of its two projections, the rollers l, mounted on the ends of the sliding rods k, and the end of which serves as a cap or housing for the axle of these rollers.

If the motor is intended to rotate in one direction only, with a constant admission of steam, the cam would then only have to be made of the total width of the two rollers, with an incline or projection whose length would correspond to the fixed period of admission which was determined upon; but in order that it should be capable of being reversed, and have a variable cut-off, either by hand or by the governor, the cam j is provided with two projections or inclines, s s', arranged symmetrically opposite to each other in the same plane, and each having the form somewhat of a right-angled triangle. The apex of each of these triangles ends a few millimeters' distance from the central plane, which is at right angles to the axis of the cam, and it terminates in the cylindrical surface of the cam. These two triangles are thus opposed one to the other at their apices, which are separated by a space equal to the thickness of one roller and corresponding to the period or position of stoppage. They each have a side situated upon one and the same generating line, and developed one to the right and the other to the left (see Fig. 4). The consequence is that, according to the position of the cam j upon its longitudinal axis and opposite the rollers l, one on each side of the cam, the rollers are raised or pushed back during the tangential travel of the cam, which is longer or shorter, according as these rollers pass over the outer part of the projecting triangles or over their apices; so that the admission can be varied from zero up to the maximum by shifting the cam. In order to change the direction of motion, it is sufficient to move the cam forward on its axis so as to bring the other triangular nose or projection into action with the rollers.

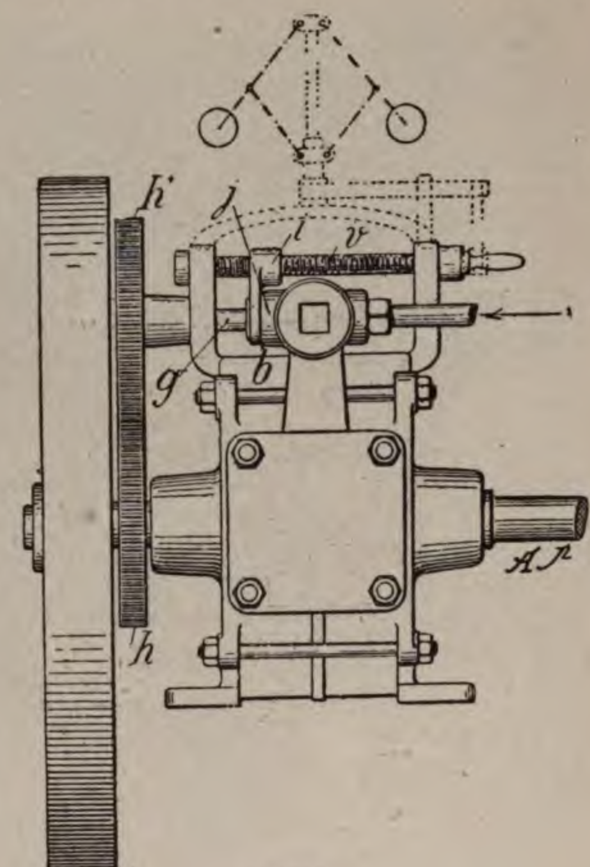


FIG. 3.

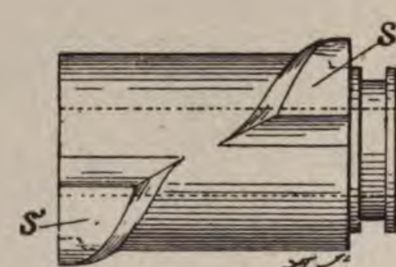


FIG. 4.

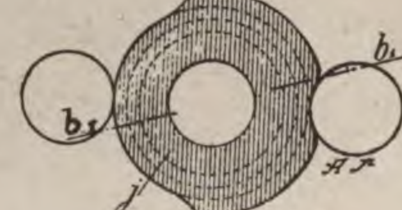
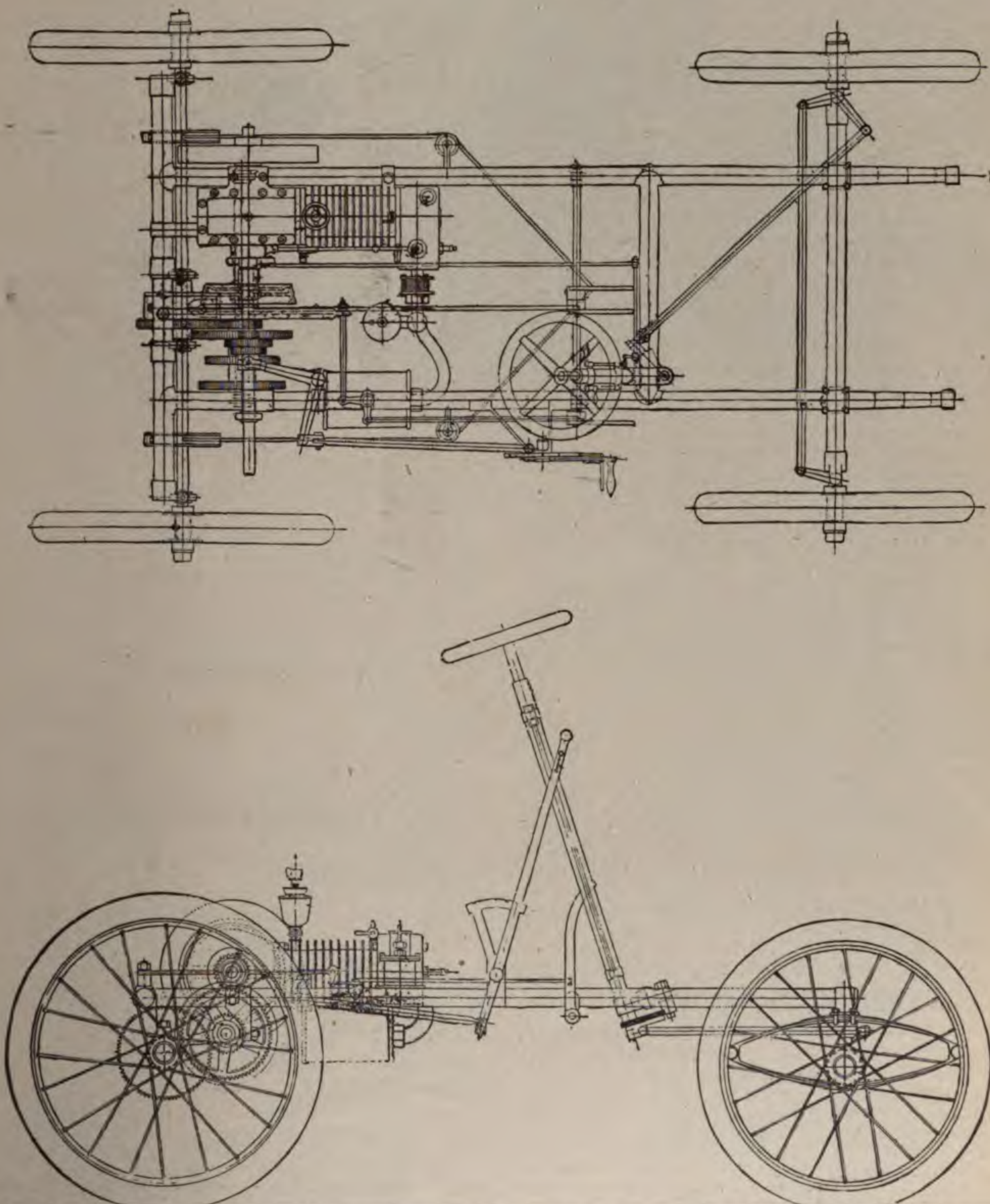


FIG. 5.

It will be seen that the operation of the cam j allows of producing forward running of the motor with any desired admission of steam, of stopping, and of producing backward running with any degree of admission.

## The Brierre Voiturette.

The accompanying illustrations show a two-seat voiturette lately brought out by M. E. J. Brierre, of 239 Boulevard



PLAN AND ELEVATION OF BRIERRE CARRIAGE.

THE BRIERRE GASOLINE CARRIAGE.

Pereire, Paris, and sold at the low price of 3,200 francs ($640). Looking at the plan, Fig. 3, the motor will be seen located at the rear left hand side of the frame, with which it is rigidly connected. The cylinder is 90 x 120 mm. (3.54 x 4.73 in.) with air cooled walls and jacketed head and valve chamber, and is said to develop 3½ b.h.p. at its normal speed of 850 revolutions per minute. Electrical ignition and Longuemare vaporizer are used. The transmission is wholly by gearing, three forward speeds being provided and no reverse. The motor shaft carries one-half of a conical friction clutch, of which the other half is on a short shaft carrying pinions which are thrown into or out of engagement with gears on the countershaft below. From the countershaft the power is transmitted to the rear axle by the pinion and gear nearest the center line of the carriage.

The frame is tubular and springs are interposed between the front axle and the frame and between the frame and rear end of the body. A band brake is applied on each rear axle and another on the differential drum. Steering is by the hand wheel shown and the gasoline and water tanks are located under the forward and rear seats respectively. The carriage weighs complete about 500 lbs. and measures 8 ft. x 5 ft. It is claimed that it will mount any ordinary gradient.

## MINOR MENTION.

Philadelphia is to have an Automobile Club.

An automobile company is being organized in Visalia, Cal., to run stages between that and adjacent towns.

The Illinois Electrical Vehicle Transportation Co. has reduced its capital from $25,000,000 to $2,500,000.

The Baltimore & Ohio Railroad is introducing electric cabs in Washington in connection with its train services.

Kenneth A. Skinner, United States agent for the De Dion and Bouton motor vehicles, has opened a store at 268 Massachusetts Ave., Boston.

The stockholders of the Lewis Motor Vehicle Co. have voted to go into liquidation. The assets are reported to be about 50 cents on the dollar.

The British America Coupé Co., with a capital stock of $3,000,000, and the Anglo-American Motor Co., with a capital of $750,000, have been incorporated in Delaware.

The new Winton racing carriaige of Albert E. Bostwick will be shipped to Europe on the 18th of this month without unpacking.

The dissensions in the Sandusky Automobile Co. have been adjusted by the withdrawal of F. M. Underwood from his membership in the firm.

John H. Parsons, of Wilmington, Del., has built a carriage which burns kerosene, and condenses its own exhaust. Its weight is about 1,500 lbs., and one lever controls the speed and steering of the carriage.

The United States Long Distance Automobile Co. has been incorporated in Elizabeth, N. J., with a capital of $1,000,000. The incorporators are Lewis Nixon, Lieut. John C. Fremont and David J. Newland.

The Electrical Review devotes its March 28 issue to descriptions of the "electromobiles" built by the Waverley, American, Columbia, Woods and Riker companies, with numerous external views from photographs.

The Electrical Review says that it is informed on good authority that no less than seven gasoline automobiles, imported from England, are at present detained by the customs authorities at Bombay and not permitted to land, owing to the fact that gasoline volatilizes at the usual temperature of the air in those parts.

Prof. John E. Sweet, of the Straight Line Engine Works, Syracuse, N. Y., is building a 6 h.p. steam vehicle engine, having splash lubrication, dust-proof case and all wearing parts accessible. There are no bolts, nuts or screws on the inside.

The Erie Foundry Co., 1350 West 12th St., Erie, Pa., have doubled their capacity, put in a complete new machine shop and have just taken an order for 1,000 engines from the Otto Gas Engine Works, of Philadelphia, Pa. They make a specialty of small motor castings.

Leon Blanchet, one of the founders of the French Automobile Club, who has been visiting in this city for the past two weeks, has offered a valuable silver cup for competition by members of the Automobile Club of America, in a 50-mile run, to take place on Saturday, April 14. The club will present trophies to those who come in second and third, and the destination will be Babylon, L. I.

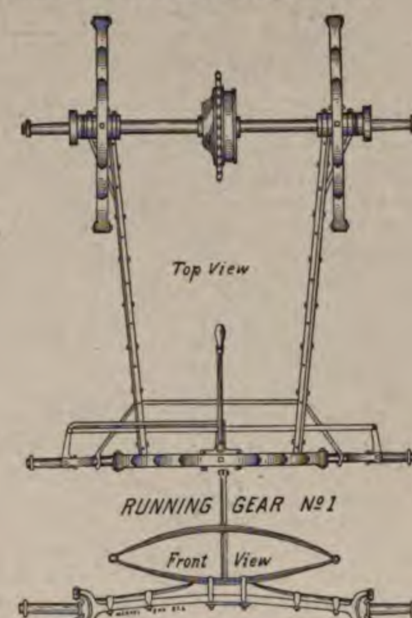
We have received catalogues from Syracuse University, the Crest Mfg. Co., of Dorchester, Mass., and the Ball Bearing Co., Boston. The last-named shows roller axle bearings for heavy and light vehicles, with ball end thrusts; roller bearing stub axles for front wheels, and a rather novel roller bearing for heavy thrusts, with the rollers short and cylindrical instead of conical.

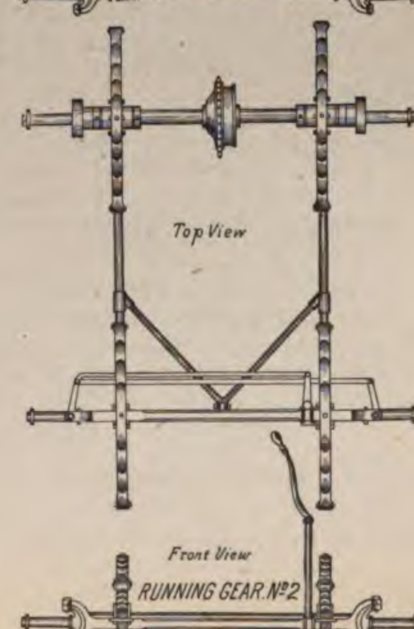
## Clark Boiler and Engine.

We illustrate a Class B carriage boiler and Class B No. 2 steam engine, built by Edward S. Clark, Boston. The boiler is of No. 10 gauge steel with triple riveted longitudinal seams; the heads are of flanged steel, 3-16 in. thick, and all rivet holes are drilled with parts in position. The boiler has 345 copper tubes, ½ in. diameter, 13 in. long; it is 15 in. in diameter and 19 in. high from the bottom of the burner to the top of the hood. It is built for 150 lbs. pressure and weighs complete 130 lbs. The engine is 2½ by 3½ in. stroke, with link motion, and weighs 40 lbs. complete with feed pump and sprocket wheel shown.


## The Borbein Running Gears.

We show cuts of the No. 1 and No. 2 Running Gears manufactured by H. F. Borbein & Co., St. Louis, Mo. The No. 1 gear has hickory reaches, ironed and braced as shown. The rear axle is continuous, with a tube from the differential to one of the rear wheels, and is provided with Borbein's No. 3 spring bearings. The No. 2 running gear has two tubular reaches braced as shown, and the rear axle is similar in principle to that of the No. 1 gear. The Borbein No. 2 self-adjusting bearings are used, and the different spring and steering arrangements can be seen from the cuts. The dimensions of the No. 1 gears are as follows: Track, 4 ft. 1 in.; wheel base, 4 ft. 6 in.; wheels, 30 and 34 in. diameter without tires; front axle, 1¼ in.; rear axle, 1⅜in.; front spring, 1½ in., 5-leaf; side spring, 1⅜ in., 4-leaf. The dimensions of the No. 2 gear are: Track, 4 ft. 1 in.; wheel base, 5 ft.; wheels, 30 and 34 in. without tires; front axle, 1¼ in.; rear axle, 1½ in., front spring, 1½ in., 4-leaf; rear spring, 1½ in., 5-leaf. Gasoline, steam or electric power can be used.



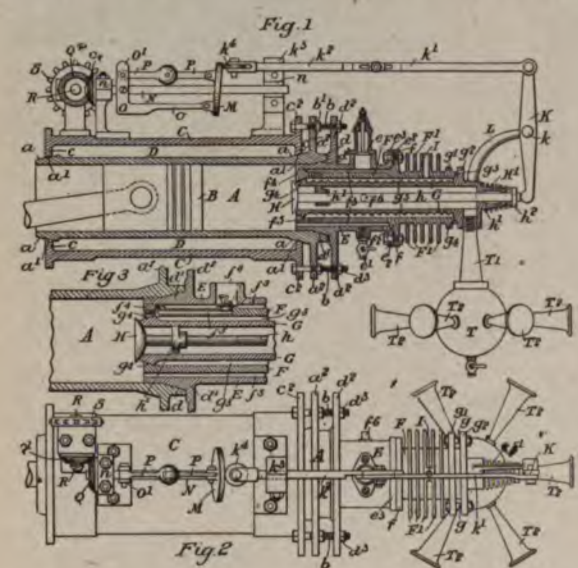



# MOTOR VEHICLE PATENTS of the world

## UNITED STATES PATENTS.

646,282—Hydrocarbon Motor.—Ernest T. Headech, Ashford, Kent County, England. March 27, 1900. Application filed May 22, 1899.

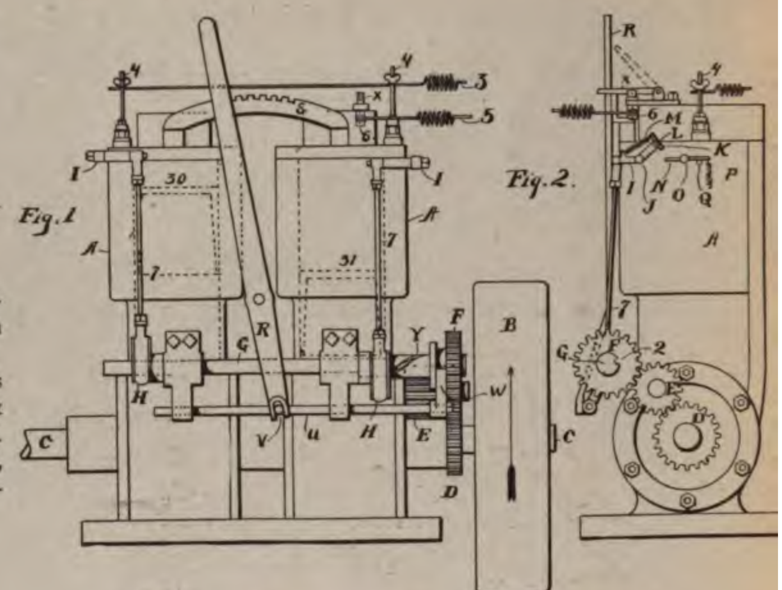
This motor is intended to use kerosene as fuel, which is vaporized in the annular space $g^5$ (Fig. 1). H is the exhaust valve, operated through the rocking lever K by the cam M. The oil is pumped or sprayed through I into the space $g^6$, which becomes filled with its vapor. e is the inlet valve, opening into another annular space, $f^3$, surrounding the first. It mingles with oil vapor issuing from the holes $f^5$, and passes on into the cylinder. The igniter is indicated by $f^6$. After release the exhaust gases pass through the expanding tube T′ into the hollow sphere T, whence they issue by way of the expanding tubes $T^2$. Governing is effected by means of the weighted links P P on the cam shaft. As the speed of the engine rises, these fly out and retract the cam disk M from its roller to a greater or less extent. The exhaust valve is consequently closed before the completion of the expulsion stroke, and a portion of the burnt gases is entrapped to mingle with the next charge.

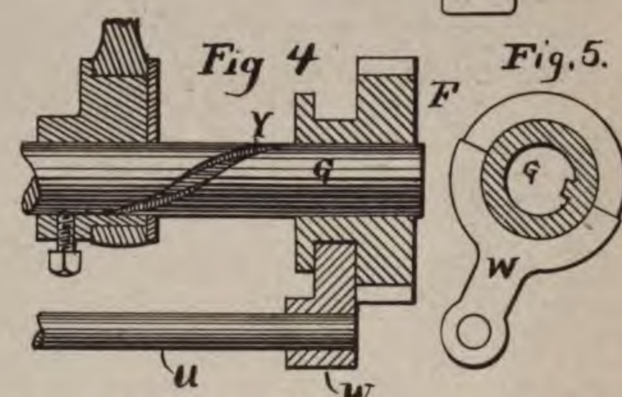


No. 646,322—Explosive Engine.—Clark Sintz, of Grand Rapids, Mich., assignor to the Wolverine Motor Works, same place. Dated March 27, 1900. Application filed May 4, 1897.

The invention comprises a method of changing the ignition-time, by which it is possible, first, to start the engine by merely operating the exploder; second, to reverse the engine without stopping, by changing the time of ignition, and third, to advance or retard the ignition at will for different speeds.

In Fig. 1 is shown a two-cylinder two-cycle engine with igniter eccentrics, H H, keyed to a secondary shaft, G, which is driven by the gears D E F at the same speed and in the same direction as the crank shaft C. A form of igniter is shown exteriorly in Fig. 2, but no claim is made for it, as the invention may be applied to any igniter operated by an eccentric. The right-hand end of the shaft G has a spiral groove, Y (Fig. 4), in which engages a tongue on the inside of the gear F, which is a sliding fit on the shaft G and may be shifted axially by the fork w on the rod u controlled by the lever R. Evidently when the gear F is shifted it will compel the shaft G to rotate to the extent of the spiral and this will change the time of ignition relatively to the position of the gear F and the crank shaft.





The pistons are shown dotted at 30 and 31 and it will be seen that one or the other is always on the down stroke. When the lever R is in mid-position ignition takes place on the center. In normal running a lead is given, determined by how far the lever is "notched up." To reverse the engine the lever is moved to the limit of its throw, which causes ignition to occur when the piston is about midway of its compression stroke; and when reversal has taken place the lever is moved to the center and a little beyond for lead.

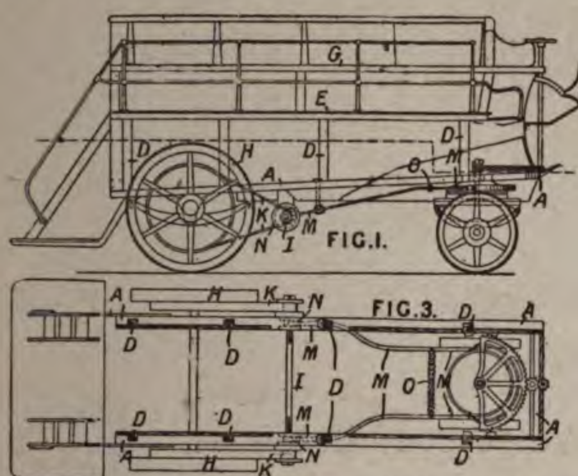
It is intended that the lever R be moved to the center when the engine is stopped, and when this is done, throwing the lever to one side or the other rotates the eccentrics far enough to produce a spark whatever the position of the cranks, and by this method the engine is made self-starting.

Five claims.

## BRITISH PATENTS.

No. 24,147—Motor Road Vehicles.—D. L. Martyn, Glen Street Engine Works, Hebburn-on-Tyne, Durham. Nov. 16.

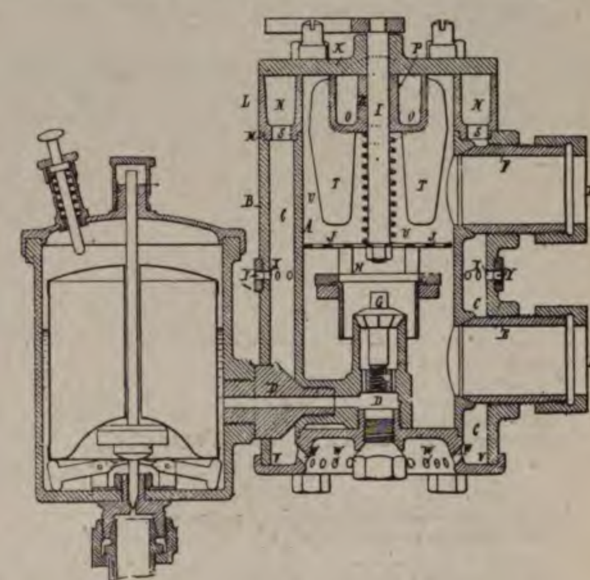
Relates to the construction of the body or framing, and to the steering and driving gear. The body is composed of a platform, E, surrounded by a hand rail and supporting seats, G, which platform rests upon pillars D. At their lower ends the pillars stand upon longitudinal sloping frame members A A. The spaces between the pillars are closed by boarding. The sloping of the frame members A affords ample room at the front end for the swiveling of the front steering wheels.




The engine, which may be of any suitable kind, drives the road wheels either through toothed or chain gear. The figures show chain gear K connecting the engine shaft I to the road wheels H. In order to facilitate steering, means are provided for utilizing the movement of the fore-carriage for automatically putting the driving gear out of action on the inner side when turning corners. For this purpose clutches N are used and the levers M for operating them are arranged to be acted upon by cams on the fore-carriage whenever it is turned toward the right or left. These levers are connected by a spring, O, so that operating the clutch lever on one side causes the clutch on the other side to be pressed more firmly into engagement.

No. 24,328—Carbureters.—A. J. Boult (communicated by A. Longuemare). Dec. 6, 1899.

The chief object of the invention consists in extending the application of the Longuemare carbureter to the production of explosive mixtures from liquid hydrocarbons of the heavy kind, as, for instance, ordinary petroleum. The hot exhaust gases from the motor enter through the tube P into the annular chamber N, and central chamber O of the part L, thence



passing through the orifices S and expanding in the annular chamber C, the register Y being closed; the gases then pass to the bottom V of the said chamber, and finally escape through the orifices W. This circulation results in imparting to the whole body of the carbureter, and especially the wings T of part L extending into the interior of the chamber U, a high temperature which will greatly facilitate the vaporization of the hydrocarbon employed. In starting it is necessary to place underneath the bottom V some heating device. In the case of such initial heating the regulator Y will be so turned as to leave the orifices X entirely open, which will facilitate the working of the heating device.

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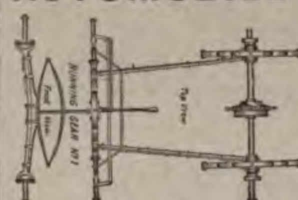

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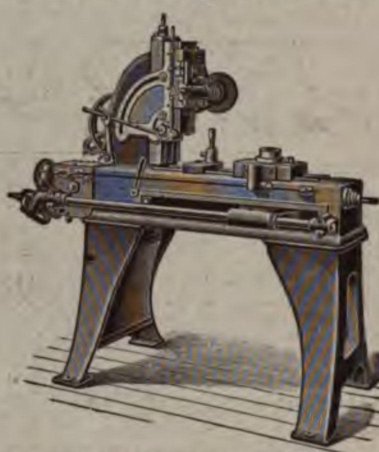

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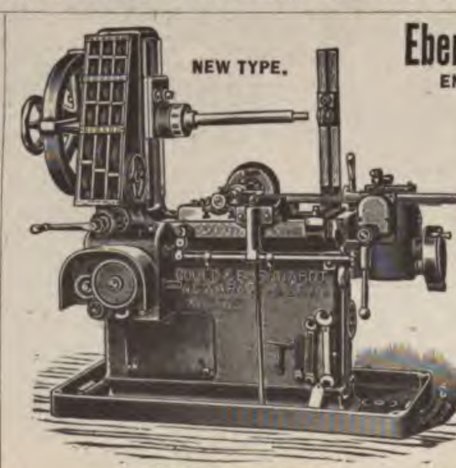

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# THE HORSELESS AGE.

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DEVOTED TO MOTOR INTERESTS.

VOL. VI. NEW YORK, APRIL 18, 1900. No. 3.

## THE HORSELESS AGE.

**E. P. INGERSOLL, Editor and Proprietor.**

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**HERBERT LADD TOWLE, Associate Editor.**

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## Wide Tires Needed.

The London Engineering recently discussed the Light Locomotives Act of 1896, which limited the weight unladen of mechanically propelled vehicles to 3 tons. It considers that the object of the act was to protect the roadways from damage by wheels, and it points out that some of the Liverpool horse drawn trucks carry loads of 10 tons, so that the combined weight of truck and load would perhaps not be far short of 12 tons. As the steam lorries cannot carry over 3 to 5 tons, making the combined weight 6 to 8 tons on four wheels, it seems hardly fair that the limit of weight for the steam wagons should be so low.

The really essential point in either case is that a vehicle of given weight should have corresponding width of tires, and Engineering quotes an English authority as proposing a gross load of two-thirds of a ton per inch width of tire. For example, a wagon carrying a load of 8 tons would weigh with fuel, water, etc., about 7 tons, making the gross load 15 tons. This would give 22½ in. of total tire width, which might be distributed in the proportion of 5 in. to each of the two forward tires and 6½ in. to each of the rear tires.

The importance of wide tires, both in preserving the road surface and in reducing the tractive force needed for propulsion, is beginning to be recognized as it should, and there is no doubt that as horse-drawn vehicles become supplanted by those mechanically propelled, either custom or legislation will effect radical changes in this particular.

## The Rampageous Automobile.

The New York Tribune of April 11 has a rousing editorial with the above title, from which we quote the following:

So long as it was a curiosity the new vehicle was regarded with a considerable degree of respect even by the man who ran it, while it inspired with prudent apprehension those who found themselves in its vicinity as they drove or took their walks abroad. But automobiles are no longer a novelty. They swarm in the streets of New York in ever increasing numbers, and the consequence is that new entries are made every day on the list of mishaps due to carelessness in their management or ignorance of their capabilities, and though it seems no time at all since they were as scarce as white blackbirds, it is not too soon to suggest the necessity of finding means to check their ravages. The vehicles which their drivers control, or are supposed to control, are mounted on rubber tires, and run almost as noiselessly as a bicycle, but are as ponderous as an elephant. Moreover, unlike the bicycle, or a vehicle drawn by horses, they are quite as much disposed to start backward as forward under the mismanagement of a driver who has lost his head or never had one, which doubles the risk of collision. Perhaps they all carry gongs, though we doubt it; and perhaps there is a rule requiring the gongs to be rung; but if so it is rarely obeyed. Silently and with fearful momentum they proceed upon their business, which is not necessarily by any means the business of the man on the box

or of the passenger inside. An Oriental running amuck is not commonly considered to be a negligible quantity; but suppose that the Oriental who happens to be taken that way weighed about three tons!

We are not sanguine of effecting a reform in respect to this matter, but would it be too much to insist that the men who undertake to run automobiles in the crowded thoroughfares of New York should understand their business? The problem of existence in this city is already quite complicated enough, without the needless multiplication of new perplexities. In various ways the automobile is a valuable invention, which promises far more than it has yet fulfilled. Presumably its future is secure, but it ought to be so regulated as to give the present generation a fair chance of surviving to witness its triumphs.

The editor of the Tribune evidently speaks from a full heart, and we suspect that he has had an unfortunate experience in the vehicle of one of his friends. In his effort to forestall the future, however, we submit that he has forgotten the progress made in the immediate past, since a bill for the licensing of automobile drivers in New York State has already been passed, and we believe was noticed in the Tribune at the time.

We would earnestly advise the editor of the Tribune not to monkey with the automobile, for it is evident that it is a subject beyond his powers.

The article on "Poppet Valves; Their Construction and Calculation," in this number, by a Frenchman intimately acquainted with the practice in his own country, may be taken as a continuation of the article on "Gas Engine Valves," by Mr. Towle, in our issue of April 4.

## An Instrument for Testing Road Surfaces.

We have received from J. Brown, Longhurst, Dunmurry, Belfast, Ireland, a copy of a recent lecture of his before the Belfast Natural History and Philosophical Society, describing a new instrument of his invention called the viagraph, for obtaining continuous records of road surfaces to which it is applied. The viagraph consists essentially of a long straight edge, which is drawn over the road, and which carries a toothed wheel on the end of a lever, which is free to move in a vertical direction, and which actuates a pencil on the end of another lever articulated to it. This pencil bears on the surface of a drum carrying a roll of paper, which is rotated by a worm and wheel connected with the toothed road wheel just mentioned, and from which the paper is rolled off in a continuous strip. The scale of the continuous diagram thus secured is full size vertically and ⅛ in. to 1 ft. longitudinally. A second pencil draws a horizontal datum line on the paper. A registering device is added by which the successive rises of the pencil are continuously added together and the irregularity of the road's surface is thus recorded in feet of vertical motion per mile. The number of feet thus obtained constitutes the "numerical index" of unevenness; and sample diagrams are given with the pamphlet from roads whose index of unevenness is from 12 to 134 ft. per mile.

It is of course easy to estimate by inspection or by riding over it the condition of any given road, but the viagraph is the first instrument, we believe, which records that condition in black and white in such a manner that the different conditions of any number of roads can be compared in a moment. We are sure that such an instrument will be of great value in the coming development of universal good roads.

## The Automobile Club's First Race.

There were 15 entries for the 50-mile race of the Automobile Club of America, from Springfield to Babylon, L. I., and return.

S. T. Davis, Jr., V. Everett Macy, William H. Hall, A. L. Barber, Jr., and David H. Morris drove steam carriages; and Albert C. Bostwick, George F. Chamberlain, David Wolf Bishop, Jr., J. C. McCoy, Jefferson Seligman, C. F. Weston and A. Fischer drove gasoline vehicles. C. J. Field, with Kenneth Skinner for his companion, drove a De Dion voiturette, and A. L. Riker had an electric racing carriage.

The race was won by A. L. Riker in 2 hours 3 minutes and 30 seconds, with S. T. Davis and A. Fischer second and third respectively. Mr. Bostwick's motor blew out a plug shortly after the start and he finished fifth.

Mr. Riker's vehicle carried 60 cells of batteries and weighed 2,500 lbs. A unique feature of the race was an unofficial contest between C. H. Tangeman and Mr. Riker. Mr. Tangeman was not entered in the race, but he started in his De Dion tricycle at the same time as Mr. Riker and beat the latter by nearly 5 minutes on the home stretch from Babylon to Springfield.

## Poppet Valves: Their Construction and Calculation.

By L. Berger.

As the valves of the high-speed gasoline engine are its most delicate organs, requiring the best thought and skill of the designer, they deserve more careful study and more scientific design than they sometimes receive.

The exhaust valve is generally made of the form shown in Fig. 1. The seat a, chambered at an angle of 45 degrees, must not be too wide, and the fillet c between the head and the stem must be of large radius. The diameter d and the thickness f are also to be made in proportion. In B is seen the slot for the screw driver, by means of which the valve is ground to its seat. The accompanying table gives the dimensions of valves for cylinders of the sizes named:

| Dia. of Piston. | Stroke. | R. P. M. | Dia. of Valve. | Width a of Seat. | Thickness f. | Lift. |
|---|---|---|---|---|---|---|
| 2½" | 3" | 1200 | 1" | ⅛" | ¼" | 9/32" |
| 3¼" | 5" | 900 | 1 5/16" | 5/32" | 5/16" | 5/16" |
| 4¼" | 4¼ | 1200 | 1 7/16" | 3/16" | 5/16" | 5/16" |

As the resistance of the exhaust valve to the outflow of the burnt gases is not considerable, the above figures for diameter and lift are sufficient.

The most suitable metal for the exhaust valve is a special alloy of nickel and steel. It may be of either of the two following compositions:*

First—Steel, 64 per cent.; nickel, 36 per cent.

Second—Steel, 62.3 per cent.; nickel, 36 per cent.; chromiun, 1.7 per cent.

Of these the first is practically inexpansible under heat, and the second expands but slightly, its coefficient of expansion being but 0.0000034 per degree Centigrade, or one-third that of medium hard steel. The second alloy is a little harder than the first, but both may be worked with equal readiness, both hot and cold. They are practically non-oxidizable, and they can be machined, using Mushet's or chrome steel tools, at the same speed and with no more difficulty than good hard cast iron.

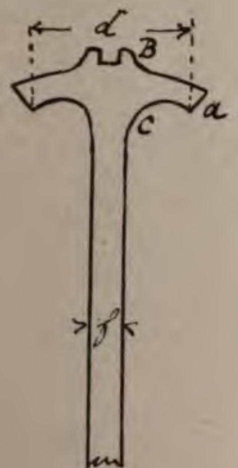



FIG. 1.

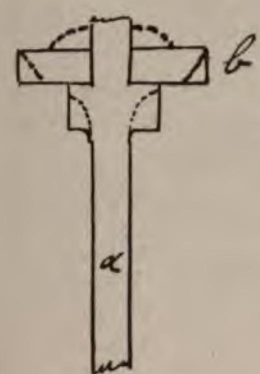



FIG. 2.

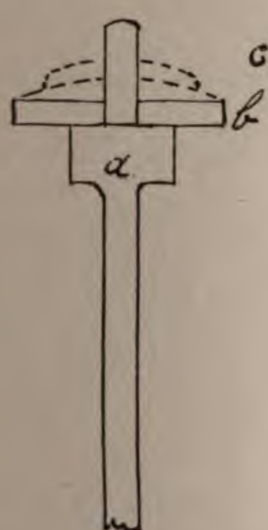



FIG. 3.

FIG. 4.

In ordinary cases the exhaust valve is made in several parts. The stem a, Fig. 2, is made of tool steel and is riveted over the disk b, the latter being made either of nickel or of the above-mentioned alloy of nickel and steel. Another design is shown in Fig. 3. In this a washer of tool steel, c, is interposed between the valve disk b and the riveted head. In each of the above cases the valve is turned off to its final form after riveting.

In the writer's opinion, however, the best method to make an exhaust valve is to form it in a single piece from one of the above mentioned alloys. In this case it is drop forged in the shape shown in Fig. 4. This construction is three times as expensive as those just mentioned, but a valve so made is far more durable, and will last a long time without deformation.

The valve seat must of course be absolutely concentric with the bushing or the bearing in which the stem moves, and a good method of insuring this is to use the milling tool shown in Fig. 5, formed to the shape of the valve seat. Before using this tool the bushing c should be drilled out to a diameter smaller than its finished size and large enough to fit the shank of the milling cutter. The seat is mounted on the face plate of a lathe and milled out by the cutter, which is guided above by a cap screwed on the cylinder head in the position of the valve cover. The finishing cut is made by another tool with a single cutting edge. After the seat is machined the bushing c is drilled to its finished size and the valve ground in place. The exhaust valve, as shown in Fig. 6, must have a bearing for its stem of about 2⅛ in. and more if possible. The total length of the valve stem must be as small as possible, as every addition to its weight increases its inertia and demands a stiffer spring to close it in the interval of time allowed. The spring D is let into a recess in the cylinder head, and bears at its outer end on a light cupped washer, e, which is secured by the pin f, as shown in


FIG. 5.

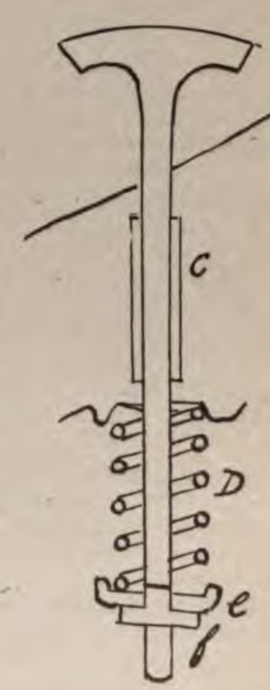



FIG. 6.

* So far as we are aware, neither of these alloys is produced in this country.—ED.

Fig. 6. This last arrangement is almost universally adopted and is considered the best.

Coming now to the suction valve, we find this a much more difficult problem than the exhaust valve. We will pass briefly over the class of cam-lifted valves, such as have been tried by some builders. In a high-speed engine it is desirable that the valves should not be closed when the piston has reached the end of its stroke, but should remain opened for a short period after the piston has begun to return. The length of this period will vary with the speed of the engine, and should therefore be automatic. This point will be referred to subsequently.

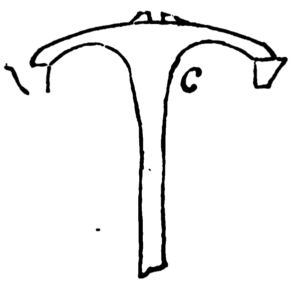



FIG. 7.

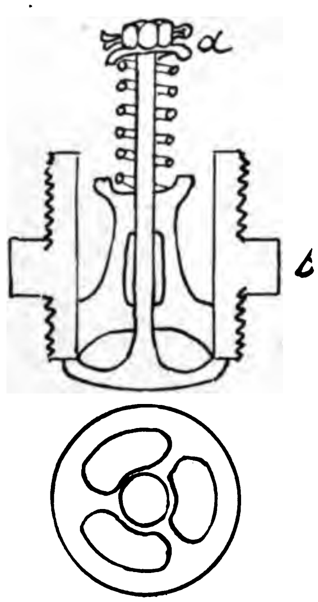



FIG. 8.

The diameter of the suction valve will depend on the speed of the engine. It is always well to make it as liberal as possible, having due regard for lightness of weight and strength to resist deformation. The usual and best form for this suction valve is shown in Fig. 7. The fillet c should not be of too small radius, and the seat should be flat. This latter feature admits of inexpensive construction. The seat is easily ground, and it allows of some lateral movement of the valve without leakage. It admits also of using a much shorter bearing for the stem, and this in turn helps to reduce the weight of the valve and consequently the stiffness of the spring. The appended table shows the usual practice as regards dimensions. As this valve never becomes heated to the point of incandescence, it may be made of Martin's hard steel or ordinary tool steel.

| Dia. of Piston. | Dia. of Valve. | Width of Seat. | Thickness f. | Thickness t. |
|---|---|---|---|---|
| $2\frac{1}{2}''$ | $1\frac{1}{16}''$ | $\frac{3}{32}''$ | $\frac{5}{32}''$ | $\frac{3}{32}''$ |
| $3\frac{1}{4}''$ | $1\frac{3}{8}''$ | $\frac{3}{32}''$ | $\frac{3}{16}''$ | $\frac{3}{32}''$ |
| $4\frac{1}{4}''$ | $1\frac{7}{16}''$ | $\frac{3}{32}''$ | $\frac{7}{32}''$ | $\frac{3}{32}''$ |

The valve is generally mounted as shown in Fig. 8. In a the spring retaining washer is preferably held by a nut which is locked by a pin. The sides b are cut off octagonally to receive a wrench.

The utmost facility is desirable in extracting the valve, and any other arrangements conducing to this end are to be commended.

Having thus described the construction of the valves, we will now consider the calculations for the springs, with the object of obtaining without experimenting the best performance possible.

The first step is, having known the lift of the valve, its weight complete with spring, washer, etc., and the mean tension of the spring, to calculate the time required for the spring to close the valve. In the case of the exhaust valve it is obvious that the cam must not be so designed as to seat the valve more quickly than this; and with a given arc of the crank circle allotted to this duty, the engine must not be run at a higher speed than is thus provided for, else the roller will leave the cam. In the case of the suction valve we may assume without serious error that when the engine is running at full speed the valve remains open till the piston reaches the end of its stroke; and the valve must then be closed before the slight vacuum in the cylinder has been converted by the return of the piston into an excess of pressure above atmospheric.

The time required to close the valve may be calculated from the fundamental expression for the acceleration of a moving body under a constant force. This expression is

$$S = \tfrac{1}{2} f t^2,$$

in which

$S$ = the space traversed in the given time.

$f$ = the gain in velocity, or acceleration per unit of time.

$t$ = the time consumed in traversing the space S.

The space S is measured in feet, the time t in seconds and the accelerations in feet per second. To apply this formula we remember that

$$m = \frac{w}{g},$$

in which

$m$ = the mass in absolute units.

$w$ = the weight in pounds.

$g$ = the acceleration due to gravity, or 32.2 ft. per second.

Also,

$$F = m f = \frac{w f}{g}$$

in which $F$ = the accelerating force in pounds, or in this case the mean tension of the spring. If we put $T_1$ and $T_0$ for the maximum and minimum tensions respectively—i.e., when the valve is open and closed—then the mean tension T will be

$$T = \frac{T_1 + T_0}{2},$$

Transposing and substituting

$$f = F \times \frac{g}{w} = \frac{T_1 + T_0}{2} \times \frac{g}{w}$$

$$S = \frac{t^2}{2} \times \frac{g(T_1 + T_0)}{2w}.$$

$$t = \sqrt{\frac{4 w S}{g(T_1 + T_0)}}$$

For example, if we limit the tension of the exhaust valve spring to a maximum value of 26 lbs. when the valve is opened, and 18 lbs. when it is closed, with a lift of 9-32 in., and if the cam is laid out so as to close the valve during 40 degs. of the crank's rotation, the above formula gives a maximum speed of 1,370 revolutions for a weight of 5.7 oz. of the exhaust valve. In all practical cases the formula is easily applied.

The conditions obtaining with the suction valve are much more uncertain, and the best that we can do without excessive mathematical complication is to indicate a sufficiently close approximation. As was above mentioned, the mixture never enters the cylinder at atmospheric pressure. This is due to the resistance interposed by the carbureter, the suction pipe and the valve and valve spring. Under ordinary conditions the resistances of the carbureter and suction pipe cause from 10 per cent. to 30 per cent. reduction in the density of the mixture, and this may be taken as a 20 per cent. on the average. Again, if T is the mean tension of the suction valve spring, measured in pounds, and a the area of the valve in square inches, there will be a loss of $\frac{T}{a}$ lbs. at the valve. Measured in fractions of an atmosphere, this will be $\frac{T}{14.7\ a.}$

The useful length of stroke is therefore

$$0.80\ l \times \left(1 - \frac{T}{14.7\ a}\right)$$

where l is the total length of stroke; and the piston must traverse a distance equal to l minus the above, on its return stroke, before the pressure in the cylinder equals that of the air outside. Up to this point the mixture will, if permitted, continue to flow in under its own momentum; and the spring tension should preferably be such as to close the valve at this point. If we know the speed of our motor, the period of time thus consumed is easily ascertained from a graphical determination of the fraction of a revolution corresponding to the movement of the piston.

The lost length of stroke,

$$l \left\{ 1 - 0.80 \left( 1 - \frac{T}{14.7\ a} \right) \right\}$$

works out to

$$l \left( 0.20 + \frac{0.80\ T}{14.7\ a} \right)$$

For approximate calculations the factor due to the resistance of the carbureter may be omitted, and the lost length taken as

$$l \times \frac{T}{14.7\ a}.$$

There is another condition to be considered here. The time required for closing the valve is dependent on the degree of the lift, and this lift is determined by the velocity with which the mixture impinges against the valve's disk. To calculate the time of closing, therefore, it is necessary to calculate the velocity and the lift. The formula for the pressure of wind or fluid on a flat surface is

$$E = \frac{v^2\ s\ \gamma}{g}$$

in which

v is the velocity of the fluid.

s is the area of the surface in square feet.

$\gamma$ is the density of the fluid.

g is the acceleration due to gravity, as above.

As we are considering only the cup-shape valve disks, which act to catch and retard the mixture more than a flat disk would, we may consider the above value doubled, so that in our case

$$E = \frac{2\ v^2\ s\ \gamma}{g}.$$

E is measured in pounds and $\gamma$ is measured in pounds per cubic foot, and in our case is approximately 0.08.

This formula, while necessarily only approximate, is an important one, and by its use much preliminary experimenting may be dispensed with.

As an example of the use of this formula we may take the following:

Weight of valve = w = 1 oz.

The diameter of valve = d = 1 7-16 in.

Revolutions per second = 13.

Diameter of the piston = 3 5-16 in.

Length of stroke = 5⅛ in.

We will assume 25 oz. = 1.56 lbs. for the tension of the spring. We have therefore,

$$T_1 = E = \frac{2\ v^2\ s\ \gamma}{g} = 1.56$$

from which we obtain

$$V = 167 \text{ ft.} = 55\ 2\text{-}3 \text{ yds. per second}$$

for the required speed of the entering mixture. This is the speed at the valve's opening; in the suction pipe it will be about 19 yds. per second on the assumption that the diameter of the pipe is equal to that of the valve. We have, therefore, for the lift of the valve,

$$\text{Lift} = S \frac{\frac{\pi d^2}{4} \times 19}{56.6 \times \pi d} = \tfrac{1}{8}'' \text{ nearly}.$$

The time required to close the valve is

$$t = \sqrt{\frac{4\ w \times \frac{1}{8} \text{ in.}}{1.56\ g}} = 0.007 \text{ sec.}$$

which, at 13 revolutions per second, comes to about 33 degs. on the crank circle.

The lost portion of the stroke, due to the resistance of the valve spring, is (if we neglect that due to the carbureter)

$$l \times \left(\frac{1.56}{14.7 \times 1.62}\right) = 0.0652$$

which is the versed sine of 69 degs. nearly, so that the crank traverses 31 degs. from the outer dead center before the pressure in the cylinder equals that in the pipe—a result agreeing very closely with the time required to close the valve. The assumed tension of the spring, 25 oz. or 1.56 lbs., is therefore a little greater than strictly necessary.

The case here given was that of an actual engine, and the writer may add that the calculated results were perfectly satisfactory, and that either less or greater tension of the spring gave poorer results than did the above.

## Motor Vehicle Notes From Germany.

By P. M. Heldt.

Although the first gasoline automobiles in Germany were built in the early eighties, the industry progressed very slowly here at first, and the field remained to a few firms for a long time. To-day the Daimler and Benz companies, which were the first and most prominent concerns in this new industry, have each built something like 2,000 vehicles, while the date of the formation of most of the automobile manufacturing concerns is comparatively recent. It was stated in an editorial in La France Automobile some time ago that of the vehicles so far manufactured by the Daimler and Benz companies a great many have been imported in France. If this be the case, French manufacturers now have their revenge,

for one meets on the streets of the larger German cities not a few automobiles of French construction—De Dions, Panhard Levassors, Decauvilles, Peugeots, etc.

Quite a number of carriage and bicycle builders have recently entered the automobile industry in Germany. Of these the first mentioned mostly devote themselves to the manufacture of electric vehicles, for which they receive the batteries and machine parts from electric manufacturers, while they confine themselves to the carriage work and the assembling. In the electric vehicle the carriage work forms, as a rule, a more important part, and the outlines follow more those found in general carriage construction than is the case with vehicles equipped with other motive powers. Most of the larger electric manufacturers have worked out electric equipments, which they sell to carriage builders. The electromobile industry takes here, therefore, a form which a company in the United States tried to give it there some three to four years ago, but which attempt seems to have failed.

The bicycle manufacturers who enter the automobile industry mostly take up the gasoline vehicle, in which the machine work forms the most important part, and for which they are especially fitted by their experience in the bicycle line.

There are in use in all the larger German cities a large number of delivery tricycles, which, if the gasoline tricycle proves sufficiently dependable in the hands of non-mechanics and for the regular duties required in delivery work, may well be replaced by the latter. I have seen at various places experiments in this direction. The tricycles were of the ordinary type, with De Dion or Aster motor, drawing a little "voiture de remorque," in which the goods are carried. These motor delivery tricycles move with at least twice the velocity of the ordinary delivery tricycles and have a somewhat larger capacity.

The high price of horses in European countries is a factor which will encourage the adoption of automobiles to many commercial purposes. It is true that the majority of business houses which have in use one or two automobile delivery wagons have bought them for purposes of advertisement, but according to one manufacturer they are now put in use by some firms in greater numbers, and with a view to replacing horses entirely.

Gasoline vehicles are very suitable for traveling salesmen, who visit all the smaller towns and villages with samples. These places can otherwise only be reached by hiring horse vehicles. As a pioneer in the application of the motor vehicle to this purpose may be mentioned the liquor house of H. Neve, in Kiel. A salesman of this firm traveled last year through the Province of Schleswig-Holstein with a Benz light vehicle with a 3 h.p. motor. This vehicle is to be replaced this summer by a motor tricycle drawing a voiture de remorque. The price of the latter outfit comes quite a little lower than that of the four-wheeled vehicle.

Hamburg, as the greatest shipping port of the Continent, has a good deal of heavy traffic in its streets, and the same branch of automobilism which is being fostered in Liverpool is receiving a great deal of attention here. I saw in the streets a number of gasoline trucks of the Daimler Co., and also of Moritz Hille & Co., in Dresden. Both of these are constructed along similar lines. The motors, change gears and clutches are placed in front and the power is transmitted to the rear wheels by a shaft running longitudinal with the wagon, and through conical gears. The wheels are iron tired. A serious deficiency of this construction I noticed one morning while going along the street. One of the trucks attempted to climb a slight incline. There was some snow on the ground. The truck was unloaded and there was therefore little weight on the driving wheels. The motorman ran the motor up to speed and engaged the clutch, but the wheels simply slipped on the snow. This incident calls to mind the fact that not the least of the good qualities of rubber tires is their great adhesion. But rubber tires would certainly be out of place on vehicles of this type, as their high price and comparatively short life under such loads as are carried on these trucks would increase the cost of operation too much.

Another method to increase the adhesion is to drive by all four wheels, and attempts to accomplish this have not been wanting, if one may judge by the patent records. The constructions advanced must, however, become more simple to be really practical. On the other hand, it has been found by the

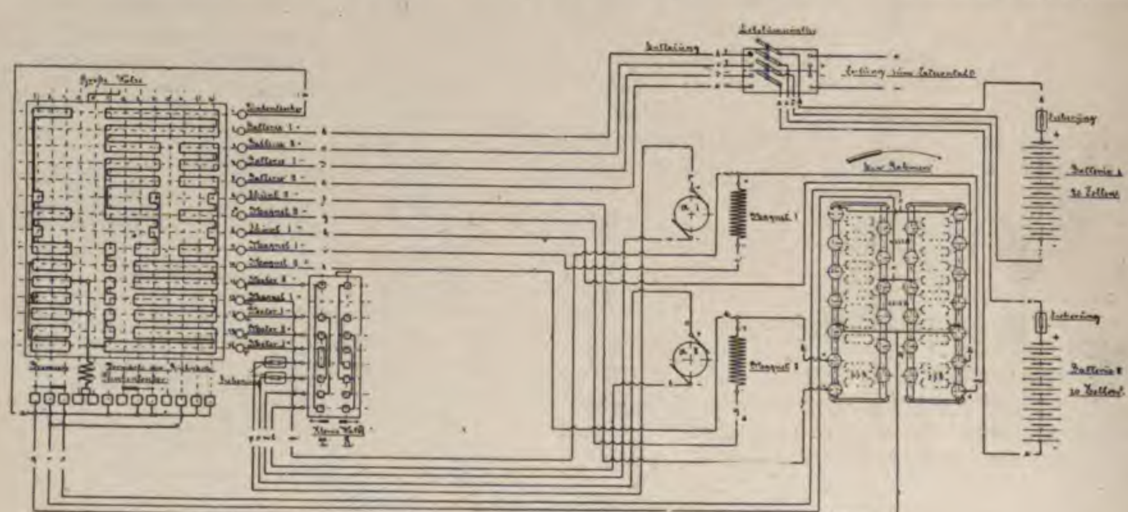


DIAGRAM OF CONNECTIONS.

GESELLSCHAFT FUER VERKEHRSUNTERNEHMUNGEN.

Siemens & Halske Co., of Berlin, in experiments made by them, that even this construction is insufficient to gain enough adhesion with ordinary iron tires on all conditions of road. The only solution of this difficulty would seem to be to keep on hand a pair of extra driving wheels having iron tires with roughened and hardened surfaces, for use at times when the condition of the streets demands it.

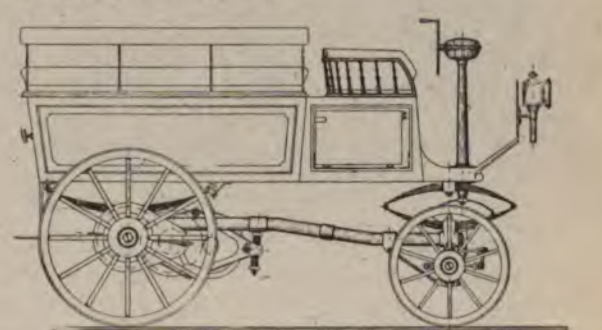
There has been in Hamburg a cab service of Daimler cabs. This service has now been discontinued. The reason for the discontinuance of the service was stated to be, by the manager of the firm that ran these cabs, that the vehicles were not practical for the very severe duties of cab service, especially on the pavements of Hamburg. The representative of the Daimler Co. at Hamburg stated that it had been impossible to get suitable men to operate these cabs, who ought to have a good knowledge of the city and at the same time some mechanical ingenuity. The cabs are now for sale. In talking with the Hamburg representative of the Daimler Co. he expressed the opinion that in Germany, and especially in Hamburg, the greatest field of application for the gasoline vehicle would be as trucks and delivery wagons. The well-to-do class of leisurers, he says, is much less numerous here than in France, and they have not that taste for the mechanical which is evinced by so many members of the French monde. The demand for private vehicles de luxe and for racing vehicles will therefore be small. It is thought that the demand for racing vehicles, even if it could be created, would not be a lasting demand, and would therefore not be a good foundation for a new industry. The Daimler Co. therefore disapprove of anything which gives automobilism the aspect of a sport. (They are nevertheless building "voitures de course" with 24 h.p. motors, probably only while the demand lasts.) For cab service and the existing local conditions the Daimler representative thinks the electric vehicle best suited.

There are quite a number of business houses in Hamburg that are using automobile delivery wagons, and an automobile 'bus line (Daimler) has been established between Wandsbeck and Farnsen, in the vicinity of Hamburg.

An old firm of carriage builders, Gebr. Kruse, in Hamburg, some time ago took up the manufacture of automobiles. The carriage works of this firm are located in the business district of the city, but for the manufacture of automobiles they have built a new factory, with a floor space of 40,000 sq. ft., in the suburb of Winterhude. This firm builds at present only electric vehicles, but will later take up the manufacture of steam vehicles for heavy work.

In Berlin the automobile is met with on the streets a good deal oftener than in Hamburg. One can find here every type of automobile vehicle, from the light gasoline tricycle to the heavy electric omnibus, represented. Especially large is the number of delivery wagons which are in service. The streets are well paved throughout the city, a good deal of the pavement being asphalt. There are also coming into existence here quite a number of firms for the manufacture of automobiles, both gasoline and electric. Of steam little is being heard here as yet. There is a company in Marienfelde by Berlin manufacturing under a license from the Daimler Co. (Motorfahrzeug und Motorenfabrik Berlin).

The large omnibuses of the Siemens & Halske Co., which run on street car tracks and from the trolley line, where there are tracks and electric lines, and on the pavement and from accumulators where there are no tracks, have already been mentioned and illustrated in The Horseless Age. They were exhibited at last year's automobile exhibition here and are still being experimented with.



BREAK OF THE GESELLSCHAFT FUER VERKEHRSUNTERNEHMUNGEN.

The General Omnibus Co., of Berlin, has just put in service a number of electric omnibuses manufactured by the Gesellschaft fuer Verkehrsunternehmungen, of this city. These omnibuses have a capacity of 17 passengers and have each a motorman and a conductor. They run regularly between the Stettiner and Anhalter railway depots, a distance of nearly 3 English miles. The run is made in half an hour and could be made in considerably less time if it were not for the crowded condition of the streets. About three-quarters of the length gone over is asphalted and the rest has a good stone pavement. On the asphalt the omnibus rides at least as easy as the ordinary street car. At the omnibus stands, in front of the depots, are erected iron poles with cross arms holding overhead charging rails. When the omnibus arrives it is run under these rails. On the top of the omnibus there are metallic bows, which are hinged and provided with springs the same as trolley poles. These bows make contact automatically with the charging rails when the omnibus is run beneath them. The batteries are charged for 20 minutes at each station. The wheels have ordinary iron tires and sand boxes are placed in front of the driving wheels, to be used when the condition of the streets renders it necessary. The omnibus is also provided with a fender. The fare is 10 pfennige ($2\frac{1}{2}$c.) for the whole trip and 5 pfennige ($1\frac{1}{4}$c.) for part thereof.


GESELLSCHAFT FUER VERKEHRSUNTERNEHMUNGEN.
BUS FOR 18 PASSENGERS.

The Gesellschaft fuer Verkehrsunternehmungen also builds cabs, delivery wagons, mail wagons and breaks. The weight of their omnibus is 3,500 kilograms (7,700 lbs.). They hope, however, to reduce this weight materially. The cabs have a weight of 1,100 kilograms (2,400 lbs.). The batteries have a capacity for a run of 40 kilometers (25 miles), but the vehicles should not be run more than 30 kilometers (19 miles) on one charge. The wagon body has a double suspension. The body is suspended from the reach by elliptic springs, and the reach is suspended from the axles by means of spiral springs. The motors are also suspended from the reach by means of spiral springs. The reach is very solidly constructed of tubing of unusual diameter.


GESELLSCHAFT FUER VERKEHRSUNTERNEHMUNGEN. BUS FOR 9 PASSENGERS.

The speed control, although electric, is effected in a different manner than is usual in the United States. The battery is divided in two halves and the controller gives four forward speeds, one backing speed, and in one position of the controller handle makes the motor act as an electric emergency brake. At the omnibus trials at the Berlin automobile exhibition of last year the emergency brake had to be applied a number of times owing to the congested condition of the streets, and it is stated that when running at a speed of 15 kilometers (9.4 miles) an hour the vehicle would stop within 1.4 meters (5 ft.).

The connections of battery and motor for the four forward positions of the controller handle are as follows:

1. The two battery halves in parallel, and the motor in series with a resistance.

2. The two battery halves in parallel, without the resistance in the motor circuit.

3. The two battery halves in series with the motor.

4. The two battery halves in series with the motor and the resistance in parallel with the field coils. Shunting the field coils by a resistance reduces the strength of field and gives the motor a higher speed. The last position of the controller corresponds, therefore, to the highest speed of the vehicle.

There is also in Berlin the Motorwagen Gesellschaft Berlin, which rents out all kinds of vehicles by the hour, in addition to selling vehicles to the public. They have at present in their "garage" 25 vehicles, of the following makes: Marienfelde-Daimler, Panhard-Levassor, Decauville, Columbia and Gesellschaft fuer Verkehrsunternehmungen. Five of the vehicles are electric and 20 gasoline. The manager of this firm stated that they have placed orders for 40 more vehicles, to be placed in service during the course of the present year. The rent per hour charged for these vehicles (with driver) is 4 marks, or about $1.

Cologne lies in the great industrial district on the Rhine, and quite an activity is manifested here in the construction of automobiles. There is first the carriage firm of Heinrich Scheele & Co., whose vehicles I saw being exhibited in Hamburg. This firm has already built vehicles for all the various purposes, and is now building a new factory in one of the suburbs to undertake the manufacture of these vehicles in quantities. The "mylord" of this firm has a very becoming form, and their truck is probably the first electric vehicle of this capacity constructed. It carries loads up to 5 tons, and is equipped with two electric motors of 6 h.p. each. The speed of the truck is about 4 miles an hour, and the distance traveled with one charge of the batteries 16 to 20 miles. The lighter vehicles of this company have solid rubber tires, while the truck has simply iron tires. The lighter vehicles also have a greater mileage capacity, being rated at from 50 to 60 miles. They will take grades up to 12 per cent.

The patents of the French automobile manufacturer, Krieger, which in the United States are owned by the Autotruck

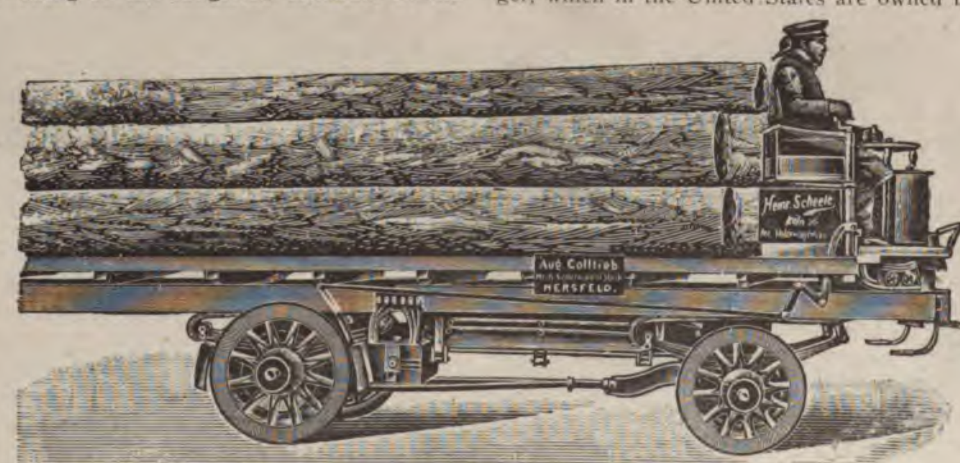



Fig. 4. Motor-Lastwagen.

Co., of New York, are in Germany exploited by the Allgemeine Betriebsactien-gesellschaft fuer Motorfahrzeuge. This company, which is located in the suburb Lindenthal, has also the agency for the Motorfahrzeug und Motorenfabrik Berlin, which was mentioned before, for this district. They had in their show rooms quite a number of vehicles belonging to these two types.

Fig. 2. Mylord-Wagen.

The Krieger vehicles, which have been illustrated in The Horseless Age before, are driven by two motors geared directly to the front wheels. The motors are mounted on an arm forming part of the steering axles, and they turn with the wheels. The front wheels act both as driving and steering wheels. The accumulators are placed in the wagon body, directly over the front wheels, which in a number of vehicle types permits of more graceful lines in the design of the body than if they were to be placed in the rear. The rear seat is also considerably easier riding when there are no batteries in the rear. The one disadvantage of this construction is the greater effort required in steering, owing to the large weight on the steering axle.

## Motor Carriage Trials.

By E. C. Oliver.

Some attention was given in a previous article to the testing of small gasoline motors. The results arrived at by these tests are of value mostly between manufacturers of motors and manufacturers of vehicles. It enables them to decide what size of motor to build and install in a carriage to obtain certain results. However, after the motor is built and installed, when the whole has become one machine and it is desired to give a prospective purchaser some idea as to the capacity and economy of the vehicle, it is of little value to state the horsepower of the motor, as this conveys to him no idea as to what the carriage will do on the road—in fact, very few who are not engineers have any idea as to the meaning of the term "horse-power." There should consequently be at hand information concerning the motor carriage in terms which are intelligible to such a person—information expressed in miles per hour under certain conditions, maximum hill climbing capacity and fuel consumption per mile under given conditions of road and grade.

Although the speed and climbing capacity of the carriage depend primarily on the brake horse-power of the motor, yet with carriages of varying design it is possible that the same brake horse-power may produce varying results. The transmission or the running gear of the vehicle may absorb more power in one case than in another, leaving less power available for propelling purposes, which fact may materially alter the road capacity and economy of the machine. To obtain results, therefore, which shall be of value to the manufacturer and user of vehicles, information is required concerning the performance of the carriage on the road.

Results of tests of this kind, to be of value, should be comparative—that is, a method of testing should be adopted which would permit of the results from one carriage being compared with the results from another. Actual road tests, however, are acknowledged to be unsatisfactory for this purpose because the conditions of road, wind and weather cannot be controlled and are different for each trial conducted, regardless of the care which may be taken in conducting the trials.

In the following discussion we will consider a method of conducting such trials by means of which all the conditions of road, grade, wind and weather may be kept constant for any number of trials, and the results from which will be comparable with absolutely no modifications or corrections. Although a similar method has not been used for testing automobiles, a modification is being used at the present time for testing locomotives, three or four plants being equipped for that purpose in this country; and very valuable results have been obtained therefrom. Similar apparatus has been used successfully for testing tricycles, and it is fair to suppose that it would prove even more successful for trials of horseless carriages.

The apparatus necessary, which will be explained in detail, while not expensive, would be of value more to manufacturers or persons having a number of vehicles to test, and especially valuable in the event of comparative trials of various makes of vehicles alluded to in a recent issue of The Horseless Age.

The apparatus or machine, shown in Fig. 1, consists in the main of a shaft of suitable length mounted in bearings and carrying at its center a brake wheel, A, and on each end a supporting wheel, B. The vehicle is placed with its front wheels resting on a platform, the height of which is equal to that of the top of the supporting wheels, and with its driving wheels resting on the supporting wheels, the centers of the driving and supporting wheels being in line vertically. The carriage is held in this position by means of an iron brace attached to the rear axle and connected to some support in the rear of the carriage. This brace allows a vertical motion of the carriage in order that it may rest with the full weight on the driving wheels, but does not permit transverse or longitudinal motion to take place.

It is evident now that if the motor is started the carriage cannot move forward; consequently the supporting wheels will revolve backward, with a peripheral speed exactly equal to the forward motion of the carriage were it on the road. If we apply a brake to this shaft the backward motion of the supporting wheel will be retarded and a load will be thrown on the motor in proportion to the resistance.

Let us follow out the construction of the machine and ascertain how nearly we may arrive at road conditions, and how nearly we may maintain these conditions.

The resistance which a carriage meets on the road may be classified as follows: The friction of the carriage running

gear, the friction due to the condition of the road, the resistance of grades and the resistance of the wind or air. The first two are always positive; the last two may be negative, zero or positive. In regard to the friction of the carriage running gear, it is evident that all parts are in motion except the front wheels, and the friction in these wheels may be replaced by the friction of the shaft supporting the rear wheels. Although there is a greater weight on these wheels than on the front wheels, if the bearings are nicely made the difference in friction will be slight and may be neglected without appreciable error.

The kind and condition of the road may be reproduced by constructing the supporting wheels as shown in Fig. 3. This wheel may be a standard pulley of light construction provided with a false removable rim of sheet steel attached to the pulley rim by short cap screws, and on which a layer of material may be attached to represent a given kind or quality of road. Supposing that we desire to represent an asphalt pavement, we would build into this rim a layer of the actual pavement, anchoring it by such means as may be found necessary and finishing the surface as is done in practice. With this construction there should be the same action between the driving

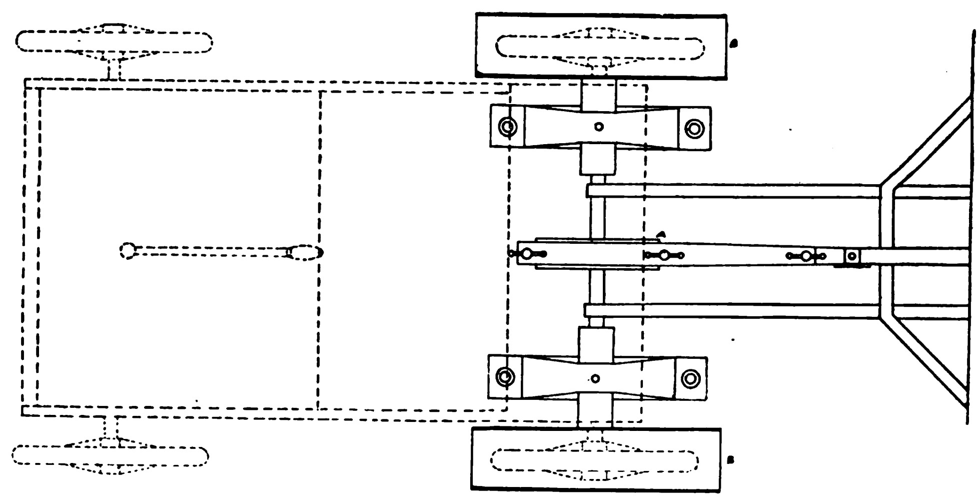
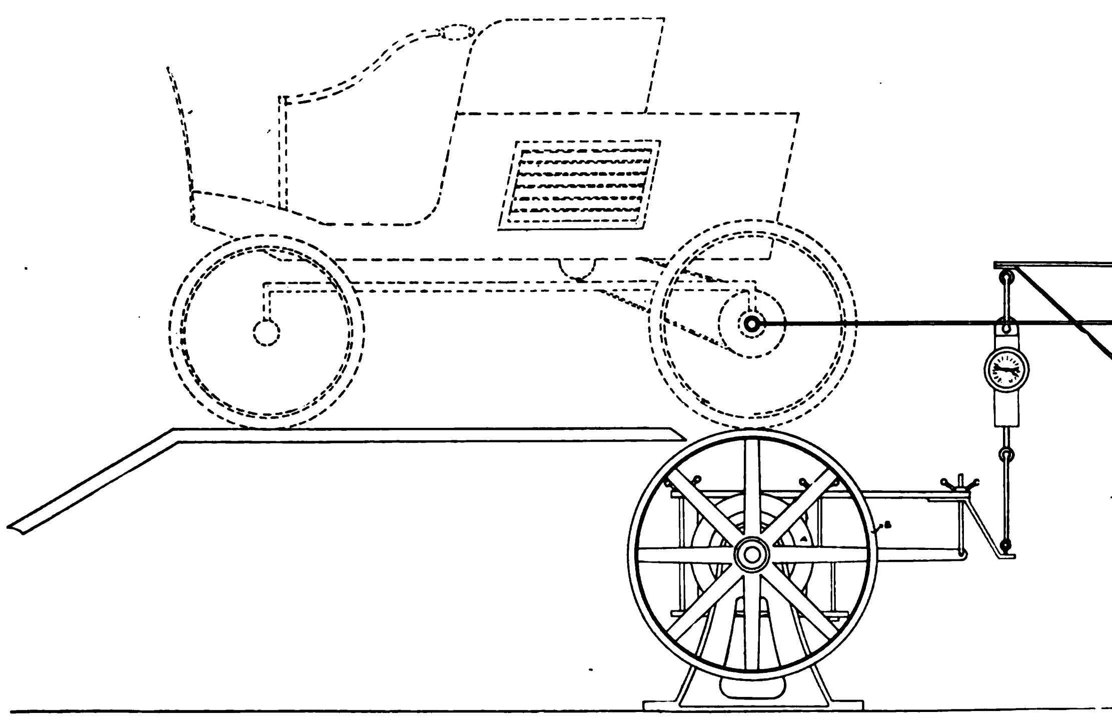


FIGURE I



wheel and the supporting wheel as will occur in actual travel over this pavement. This rim may be constructed to represent block pavement, turnpike or any other form of standard road of any degree of smoothness or roughness desired by arranging the coating to correspond.

The size of these pulleys should be such that a given number of revolutions would represent a mile traveled by the carriage. For instance, if the outer coating were 38 3-16 in. in diameter, one revolution would represent 10 ft., and 528 revolutions would be one mile traveled.

In climbing a grade the motor must overcome the road friction of the carriage, and in addition do the work of raising the weight of the carriage through a given height in a given time, depending on the degree of steepness of the grade. This work is manifest in a back pull on the carriage in the direction of motion equal to the component of the weight of the carriage down the grade, which resistance is overcome through a distance equal to the length of the grade.

The amount of this back pull or the force necessary to sustain the carriage on the incline may be computed as follows:

Let W be the weight of the carriage.

Let L be the base of the grade.

Let H be the height of the grade.

Let P be the pressure to sustain the weight or the component of the weight down the grade.

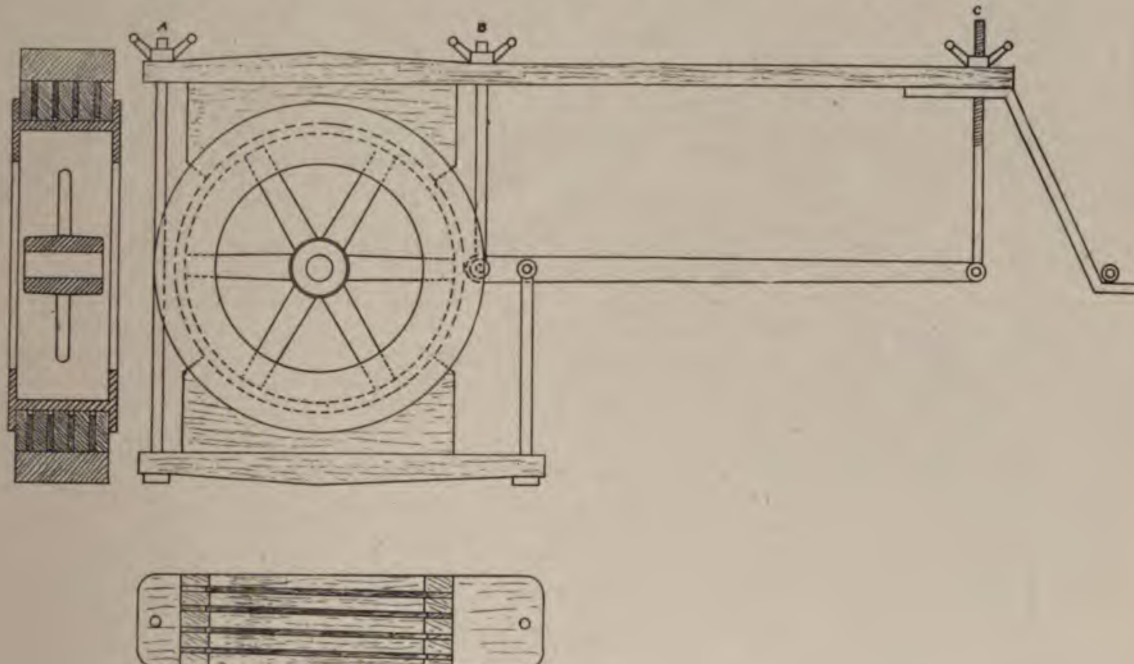



FIGURE 2

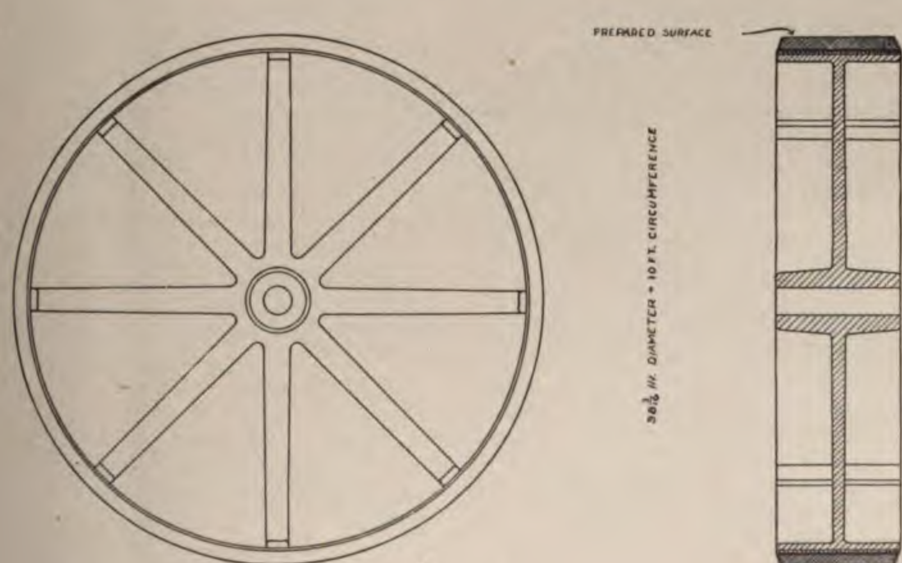



FIG. 3.

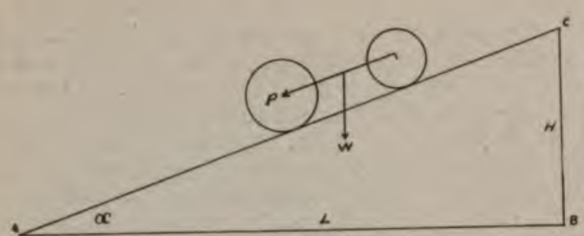



FIGURE 4

$$\text{Then } P = W \sin \alpha \text{ or } W \frac{H}{a\ c} = W \frac{H}{\sqrt{L^2 + H^2}}$$

Now, if L be taken such that $H = 1$, or, in other words, if the grade be 1 ft. in L ft., or 1 in L, we have $P = \frac{W}{\sqrt{L^2 + 1}}$

For grades varying from 1 in 5 to 1 in 100 this component is given in the following table for each 100 lbs. weight, or when $W = 100$:

| GRADE | P in Pounds | GRADE | P in Pounds | GRADE | P in Pounds |
|---|---|---|---|---|---|
| 1 in 5 | 19.61 | 1 in 30 | 3.33 | 1 in 60 | 1.67 |
| 1 in 10 | 9.95 | 1 in 35 | 2.85 | 1 in 70 | 1.43 |
| 1 in 15 | 6.65 | 1 in 40 | 2.50 | 1 in 80 | 1.25 |
| 1 in 20 | 4.99 | 1 in 45 | 2.22 | 1 in 90 | 1.11 |
| 1 in 25 | 4.00 | 1 in 50 | 2.00 | 1 in 100 | 1.00 |
| | | 1 in 55 | 1.82 | | |

If then we wish to ascertain the performance of the vehicle on grades we must apply a resistance at the point of contact of the driving and supporting wheels of such an amount as will represent the desired grade. This is accomplished by means of a friction wheel and brake attached to the supporting shaft. A convenient brake for this purpose is shown in Fig. 2. It is easily adjusted, very sensitive and smooth running, and is capable of absorbing the power of any vehicle which it may be desired to test.

The brake wheel is cast with two flanges projecting outward to act as a guide for the brake, and two others extending inward to form a trough for the cooling water.

The brake is made of maple or other close grained hard wood, the friction pieces are made of material ¾ in. thick, with a ¼-in. space between each piece, as shown in the sketch, and the rubbing surfaces are finished to fit the wheel nicely. The two screws A and B are for adjusting the brake to the wheel to obtain the proper pressure, and the third screw C is for making fine adjustments while running. A counterweight may be placed on the opposite end of the arm, of sufficient weight to balance the brake when resting on a knife edge placed directly over the center of the brake wheel. The reading of the scale will indicate the net load on the brake; otherwise it would be necessary to correct the scale reading for the weight of the arm.

If the brake arm be of a length equal to the radius of the supporting wheel, the reading of the scale will be the retarding force applied; but this arm would be too short, and it would probably be more satisfactory to have the arm twice the length or equal to the diameter of the supporting wheel, and to multiply the scale reading by two to obtain the retarding force. To illustrate, suppose we desire to represent a grade of 1 in 15 with a carriage weighing 700 lbs. From the table the resistance due to grade for that inclination is 6.65 lbs. per 100 lbs. weight, which would amount to 46½ lbs. total resistance. If now we tighten the brake until the scale shows a reading of 23¼ lbs. we will have a tractive effort of 46½ lbs. between the driving and supporting wheels, and the carriage will be doing work equivalent to propelling itself up a grade of 1 in 15.

Any grade may be thus produced, and the limiting grade for the vehicle will be found by tightening the brake until the motor is just able to carry the load. Take the reading of the scale and divide by the weight of the carriage, multiply by 100 and find corresponding number in the table in the column marked P. Opposite it will be found the grade.

We have yet to represent the wind resistance of the vehicle, which we have said may be negative, zero or positive, and which may strike the vehicle at any angle, according to the relative courses of the wind and carriage. These facts make it exceedingly hard to take account of this resistance; but if we may be able to obtain constant conditions for two tests much will be accomplished over that which is possible on the road, and it would probably be simplest to consider this resistance zero. It is evident that for the same type of vehicle it would be practically the same for like speeds, and the results from these tests would be comparable.

At low speeds the wind resistance is negligible in any case. Amounting at 4 miles per hour to a pressure of but .08 lb. per square foot against a plane, at 15 miles per hour this pressure is 1.125 lbs. per square foot. This would probably be increased in vehicles, owing to the irregular form of the surface exposed, and these results might be doubled.

If considered necessary, however, to ascertain positively the retardation due to wind, it could be accomplished without any great trouble in the following manner: A level platform should be provided on which the vehicle could be placed and revolved so as to always face the wind, and fastened in position longitudinally by means of a cord with a spring balance interposed. Now, if simultaneous readings be taken of the spring balance and an anemometer, we will have a series of results showing the back pull due to the wind resistance for all the velocities which may have been recorded. Since the wind is liable to be variable, our results will cover the necessary ground, and these resistances may be represented by adding to the friction load of the brake the necessary amount.

This might also be done more accurately, but at greater expense and trouble, by constructing a duct from a large centrifugal ventilating fan of sufficient size to admit a vehicle, there fastening it in the same manner as before and forcing air past it by means of the fan, the pull being indicated by the balance. The velocity could then be maintained constant for any length of time and more accurate results obtained. This method has already been used with success in studying the wind resistance of trains.

We have now been able to represent all the most important conditions existing on the road in a manner which would make the tests reliable, and in a manner which could be copied any number of times with certainty.

For the trial of a vehicle a course could be laid out to represent as nearly as possible an actual trip of, say, 20 miles, consisting of a given kind or quality of road and certain distances having given grades, etc.

The vehicle should be weighed and the proper brake reading computed for these grades and conditions. The load could then be varied at the proper time by noting the distance traveled, as indicated by a cyclometer attached to the supporting wheel.

In conducting tests the carriage tank (in the case of gasoline and steam vehicles) should be replaced by a graduated tank from which the gasoline used is drawn, and which would

afford a means of measuring the amount used. Readings should be taken at frequent intervals throughout the test of the height of the gasoline level and the distance travelled, and a description added of the conditions under which the carriage has been running for the preceding period.

Also in computing the brake load for any condition of grade, the weight of the passengers should be included in the gross weight carried up the incline, and passengers or weights to represent them should occupy the seat or seats of the vehicle under test.

## COMMUNICATIONS.

### Dimensions Wanted.

Editor Horseless Age:

(1) In a double-cylinder gasoline engine of the four-cycle type, what speed of engine, diameter of cylinder and stroke are necessary to develop 8 b.h.p.? Also state compression space required and give initial and mean effective pressures. (2) Give same specifications for a 6 b.h.p. engine. (3) Give same specifications for 4 b.h.p. engine. Yours truly,

M. W. J.

[The power developed by a gasoline engine will depend somewhat on the details of its cylinder and cylinder head design, and a good deal more on the character of the vaporizer and the igniter. With good design in these particulars, the following dimensions should be sufficient:

1. 5 by 6 in. at 700 revolutions per minute.
2. 4¼ by 5 in. at 750 to 800 revolutions per minute.
3. 3½ by 4¼ in. at 800 to 900 revolutions per minute.

A good rule is to make the compression space 0.35 of the volume swept by the piston for the larger sizes and 0.4 for the smallest.

You will find an account of the method of calculating the initial and mean effective pressure in the article by E. J. Stoddard in The Horseless Age for Aug. 30, 1899. In vehicle motors the actual results will be somewhat less than the calculated, owing to wire-drawing of the charge and sluggish inflammation at high speeds.—Ed.]

### The Battery Wires Again.

New York, April 9.

Editor Horseless Age:

Answering your inquiry regarding the transposing of wires at the batteries, I would relate my own experience, which is somewhat different from Mr. Wales'.

About two years ago, on putting in the freshly charged set of storage batteries for sparking the motor, I found it impossible to get the motor to run, although it had run perfectly the day before. I spent about a half hour every day for a week, looking over and testing every part, but in spite of every ignition point giving a good spark and persistent pumping on my part, there was no "go" in that motor. Having also tested the gasoline, only one thing remained to try that might help, though I hardly expected that to, and that was to change the wires at the battery. On making the change the motor started off at once. Since then I have been careful to connect the wires up the same way.

The motor in this case is a four-cylinder one and the wires from the four ignition plugs run to a commutator so as to be put into connection in rotation. The brushes are mounted on a vulcanized fiber plate on which are also the two brushes for the primary current of the induction coil, and the probabilities are that there is a leakage of some sort through this supposed non-conductor if the current runs the other way. Apparently the spark was just the same, but with the exception of an occasional explosion it would not ignite, while as soon as I changed the wires not an ignition was missed.

H. W. S.

## MINOR MENTION.

The latest is a portable barn for your automobile, shipped in knock-down and put up with a screwdriver.

There are now six horseless carriages in Reading, and there is talk of a local speed contest.

The Detroit Automobile Co. are now getting out 12 vehicles with standard gears and interchangeable bodies.

A temporary organization of the Reuter Automobile Co. has been effected at Davenport, Ia. The capital stock is $500,000.

Banker Bros., of Pittsburg, are importing motor bicycles and will also handle the Waltham Mfg. Co.'s line. They are looking around for agents.

The Winton Motor Carriage Co. have arranged to occupy the entire building where they are located, increasing their floor space to about 80,000 sq. ft.

The Woods Motor Vehicle Co., of Chicago, is reported to be building "the finest electric victoria in the world" for W. K. Vanderbilt. The price to be paid is $5,000.

The Edie Mac Automobile Co., with a capital of $250,000, has absorbed I. D. Langen's factory at Reading, Pa., and will manufacture steam automobiles. Automatic igniters for the burners and automatic boiler feeders are the important features of these vehicles.

Motor vehicle builders looking for a factory site will be interested in the coming sale of the John Stephenson Co.'s property, announced in our advertising columns. The shipping facilities, electric lighting, artesian wells and up-to-date equipment in general make the property a most desirable one.

The Noye Mfg. Co., of Buffalo, N. Y., who manufacture two-cycle marine motors and four-cycle carriage motors with water jackets, are placing on the market a 3 x 4 in. flange-cooled motor for tricycles and other light work. Their catalogue of marine motors will be mailed to any address on receipt of postal.

The storage battery street railway which the promoters of the Lead Cab Trust have been operating at Englewood, Ill., as a bright and shining example of the success of the storage battery in the field of traction, has proved too expensive an advertisement to be longer maintained. The directors have voted to substitute the trolley for the chloride accumulators.

The Columbia & Electric Vehicle Co., Hartford, Conn., are reported to have purchased the well-known patent of George B. Selden, Rochester, N. Y., on a hydrocarbon road engine, a patent which was held in abeyance in the Patent Office for 15 or 16 years prior to issue, and about the value of which there has been much speculation.

The Winton Motor Carriage Co. is turning out automobiles at the rate of almost two a day.

The German Kaiser has offered a prize of $20,000 for the best automobile for military purposes.

An effort is being made to organize an automobile club in Rochester, N. Y. J. J. Mandery, of that city, is one of the moving spirits.

Prince Pierre d'Arenberg has just offered to the sport committee of the Automobile Club of France the sum of 1,000 francs as a prize for a race for automobiles driven by alcohol.

The Portland (Me.) Advertiser announces the organization of the Eclipse Automobile Co. at that city. It says that the capital stock is $50,000 and that $70 is paid in. We suspect a misprint.

Governor Roosevelt is reported to have said, in reference to the Goodsell bill for chartering the New York Electric Vehicle & Transfer Co., that he will sign no bill that will create a monopoly. It is claimed by the officers of the company that no monopoly is granted by the bill.

The Century Vehicle Co., Syracuse, N. Y., have rented factory accommodations at 517 East Water St. and are preparing to place on the market steam, electric and gasoline carriages. The officers are: Charles F. Saul, president; Charles Listman, vice-president; Charles A. Bridgman, secretary and treasurer, and William Van Wagoner, engineer and manager. The company is now ready to take orders for a 1,300-lb. electric carriage.

The Foster Automobile Co., Rochester, N. Y., have leased the top floor and half the store front of the building at 311, 313 and 315 State St., and will use the premises as assembling, upholstering and salesroom, continuing to construct their boilers, engines and gears in the plant of the Shipman Engine Co. They now have 180 carriages in process. The boilers, 16 x 16 in., contain 350 tubes, and the total weight of the vehicle is 800 lbs.

H. A. Middleton, superintendent of the Pennsylvania Rubber Co., Erie, Pa., has invented an automobile tire whose special feature is that the side walls of the inner tube are thickened, so that they are not cut through if used after accidental deflation. Strips of rubber are vulcanized between the layers of fabric, which is claimed to increase resiliency and lessen liability to puncture. It will be known as the Middleton Tough Automobile Tire, and arrangements are being made for its manufacture.

## METROPOLITAN NOTES.

The Latimer Rubber Tire Co., of Huntley, Ill., have an Eastern office at 15 Platt St.

Chas. E. Miller, 97 Reade St., informs us that he has given up the selling agency of the "P T" motors.

H. D. Smith & Co., Plantsville, Conn., makers of drop forgings for automobiles, have opened a New York office at 253 Broadway.

The Compressed Air Co., of New York City, has been incorporated, with a capitalization of $8,000,000. They will begin business with $15,000.

While in conversation with a representative of Messrs. E. A. Williams & Son last week we were very much impressed with the necessity of calling the attention of Automobile Manufacturers to the fact that it is now the practice of many founders to fill orders for phosphor bronze with a metal that is not phosphorized at all.

It would be an easy matter to ascertain this deception by once getting a sample order of the genuine phosphor bronze, when the substitute could be readily detected, as it bears no resemblance to the original whatever, either in the skin of the metal, its color, the working or the wear of it.

# MACHINERY and TOOLS for motor vehicle builders

## The Baush & Harris Multiple Drills.

The word "multiple," when applied to a drilling machine, may mean much or little, depending upon the adaptability of such a machine for different kinds of work. A machine might be designed with two or more spindles for some particular work and be capable of effecting that work economically and satisfactorily. Such a machine would be a multiple drill, surely, but when considered as an economical tool in its fullest sense would of course fail to meet the claim.

If, however, a machine is so designed and constructed that while filling the requirements of a special tool it can also without trouble or delay be adjusted to meet the necessities of other work, whether to its full capacity or otherwise, then such a machine becomes "multiple" in the fullest sense of the word, and is proportionally valuable as a shop tool.

A machine which fully meets these conditions is shown in the annexed illustration. Not only does it meet the conditions stated, but it effects a result which is not always considered at first thought, and that is that for every spindle working it is saving the time and expense of one other ordinary drilling machine, for taking the factor of handling into account, it will drill as many more pieces in the same time as there are holes in the layout.

One great advantage in this machine over some other multiple drills is the fact that the whole head moves to and from the work by power or hand feed at the will of the operator, thus allowing the work being placed upon the bed plate or table, as desired.

Another advantage is that each drill spindle is freely adjustable and independent of the others.

The field which such a machine can cover is wide and varied, and a little thought will show how splendidly adapted it is to any work of a multiple or duplicate character within its range.

The sizes regularly built by the company contain 4, 8, 12, 14, 16 and 24 spindles, or any desired number, in fact. The larger sizes are suitable for drills up to 1½ in. diameter, while the smaller are designed for 1-in. drills or less. The space covered varies from 4-in. to 36-in. circles.

The Baush & Harris Machine Tool Co., Springfield, Mass., make a specialty of these machines, which are built under the Baush & Oehring patents.

The standard radial drills and boring mills built by this company are the result of long experience and are splendid tools.

Their new shops at Springfield are finely equipped for the manufacture of their machines, and it is withal a model plant.

# MOTOR VEHICLE PATENTS

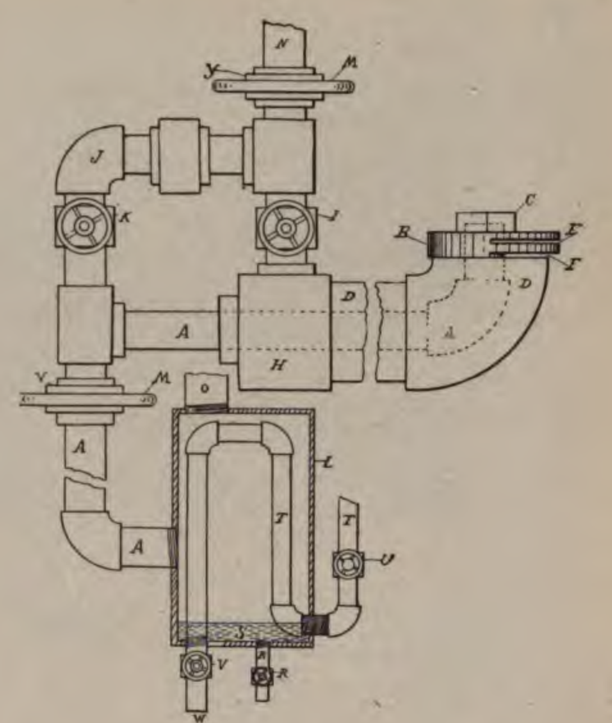
## of the world

### UNITED STATES PATENTS.

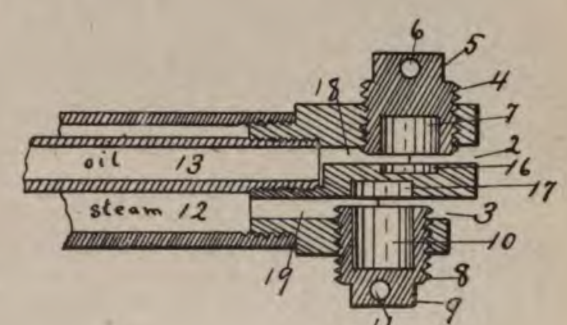
No. 646,385—Hydrocarbon Burner.—Milon O. Godding, Monrovia, Cal. Dated March 27, 1900. Application filed Sept. 27, 1898.

The object of the invention is to provide an atomizing burner for crude oil, which burner shall first warm the oil by a steam jacket around the oil pipe, and then use a steam jet to spray the oil. In the figure L is a separator to drain any water from the oil, whose proper fluidity is assured by the steam warming pipe T. From L the oil passes by the pipe A to the atomizing jet B and the semicircular nozzle E. Steam enters by the pipe N to the jacket D and thence issues from B by the nozzle F, whose upper edge projects slightly, as shown, to prevent the expansion of the steam from driving the flame too high. The by-pass J is to blow out the oil pipe and is normally closed. The burner appears to be intended mainly for large powers.

Three claims.



No. 646,386—Hydrocarbon Burner.—Milon O. Godding, Los Angeles, Cal. Dated March 27, 1900. Application filed Dec. 29, 1898.




This is a steam jet atomizer for crude oil and the apertures for oil and steam are made adjustable by the screw plugs 5 and 9. The recesses in the plugs and in the lip separating the two apertures are to equalize the force of the flow of the oil and steam and render it more uniform throughout the width of the jet.

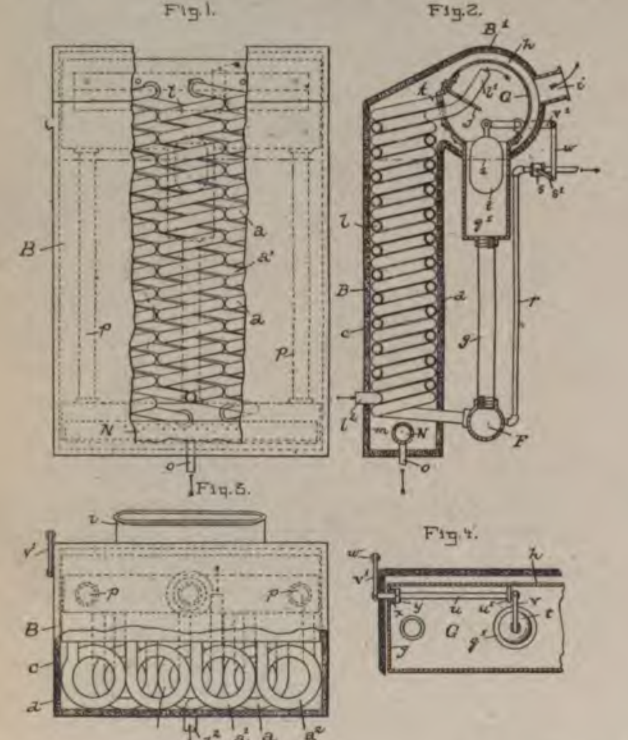
Four claims.

646,727—Steam Generator.—Walker L. Crouch, New Brighton, Pa., assignor to the Columbia Motor & Mfg. Co., Washington, D. C. April 3, 1900. Application filed June 20, 1899.

This is a water-tube boiler for carriages, with automatic regulator for the water level. Referring to the drawings, Fig. 1 is an elevation in which part of the walls of the inclosing case are broken away to show the coils. Fig. 2 is a vertical section through the center, showing all the parts. Fig.

3 is a plan in which the upper part of the wall is broken away to show the arrangement of the coils. Fig. 4 is a plan showing the float whereby the water inlet valve is automatically operated.

A number of vertical coiled water-heating tubes, a a' $a^2$, have their coils interlapped, one within the other, as shown—that is to say, the coils of the several tubes are wound alternately right and left and the coils of each tube are open spaced sufficient to permit the coils of the adjoining tubes on each side to intermesh or interlap. For instance, the coils of the two tubes a' $a^2$, which are at opposite sides of the tube a, both intermesh between the coils of said latter tube. All of these coils of water tubes are inclosed in a case, B, lined with asbestos or some other non-conductor. Each of the coiled tubes has its lower end e extended through the wall of the case and connected with a horizontal base drum or manifold, F, from which water is supplied to all the coils.




Within the steam drum G is a baffle plate, j, as seen in Fig. 2, and the upper end k of each tube opens into the steam drum just below the said baffle plate. A steam pipe, l, is also within the case B, and its several coils intermesh or interlap with the coils of the water heating tubes a' $a^2$ on either side. The upper end l' of this steam pipe enters the steam drum G, and its end opens in the top of the drum above the baffle plate, where the steam will be dry. The lower end $l^2$ of the steam pipe projects through the wall of the case, as seen in Figs. 2 and 3, from which point it may be conducted to an engine. This pipe supplies superheated steam.

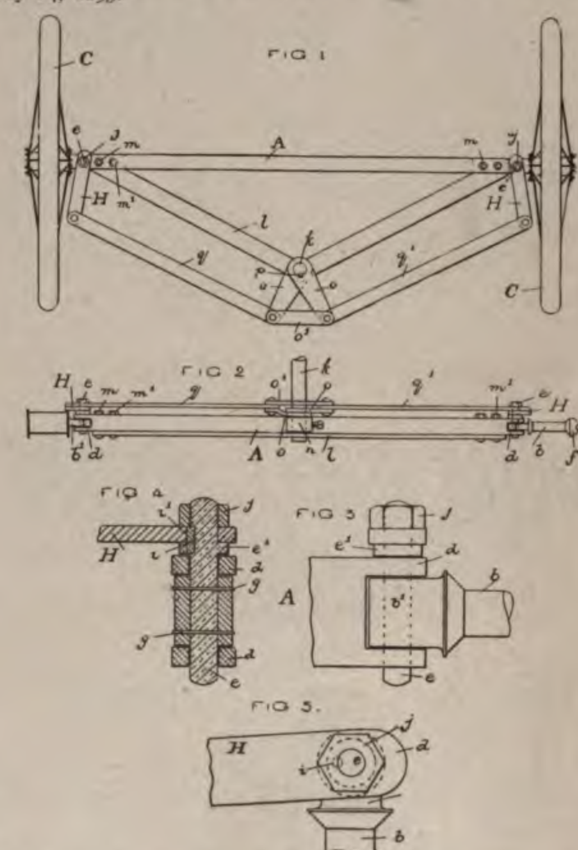
The steam drum G is vertically above the water drum F, and the two are directly connected at both ends by a vertical leg, p, and by a central pipe, q, having at its upper end an enlarged water-column part, q'. The water-supply pipe r enters the base drum F, and in this pipe is a valve, s, which controls the supply of water. This valve is regulated automatically by the float t, so as to maintain an approximate constant height of water in the generator, as denoted by the broken line z in Fig. 2.

Provision is made for insuring a steam-tight joint and to prevent leakage where the rock shaft u passes through the head of the steam drum, without employing a stuffing box, by means of the collar y, bearing against the boss x on the drum head. The steam pressure in the drum G keeps the collar y tightly seated against the boss x, and thus leakage of steam is prevented.

The burner N, of any suitable design, is shown at the bottom of the case.

Two claims.

646,728—Automobile Steering Gear.—Walker L. Crouch, New Brighton, Pa., assignor to the Columbia Motor & Mfg. Co., of Washington, D. C. April 3, 1900. Application filed July 14, 1899.




A is the axle, which is rigid against rotation, and from which the truss bars l reach back to provide a bearing for the steering post k. The short levers o o, keyed to the steering post k, are connected by the link o', forming practically a rigid piece, which is connected by the rods q and q' to the steering levers H H on the pivot pins e. The levers H H are keyed to the pivot pins e in the manner shown, and the pins g g transmit the motion of e to the stub axles b b'.

One claim.

646,803—Vehicle Driving Mechanism.—Eugene Childs, Boston, Mass., assignor of one-half to Edward O. Ely, same place. April 3, 1900. Application filed Nov. 23, 1899.

A friction disk mechanism. Fifty claims.

ADVERTISING SUPPLEMENT.

FACTORY OF THE MOBILE COMPANY OF AMERICA—VIEW LOOKING SOUTH.

## THE LARGEST AUTOMOBILE FACTORY IN THE WORLD.

LOCATED AT KINGSLAND POINT ON THE FAMOUS PHILIPSE MANOR PROPERTY. THE WORK OF PREPARATION REQUIRED TO BUILD SIX HUNDRED CARRIAGES PER MONTH. HISTORY OF THE DEVELOPMENT OF THE HORSELESS CARRIAGE IN THE UNITED STATES.

THE first MOBILES were turned out at the factory of THE MOBILE COMPANY OF AMERICA at Kingsland-Point-on-the-Hudson during the month of March. Nine months before, two hundred and thirty-three acres of the famous Philipse Manor property, having nearly a mile of river frontage on the Hudson and bisected by the New York Central Railway, was purchased with the idea of building there an automobile factory of such extent that the cost of production could be brought to the lowest possible figure. While the factory was in course of erection, a corps of engineers and experts under the direction of the Messrs. Francis and Freeland Stanley was engaged in strengthening and improving the carriage and perfecting methods and special tools for the manufacture of the automobile carriage invented by the Messrs. Stanley.

The carriage thus perfected is to be known as the "WESTCHESTER COUNTY MODEL" to distinguish it from the carriages of the Stanley design turned out at the works in Massachusetts. It carries the very latest improvements, and the orders for its construction have been to use only the finest quality of material and to spare no pains to turn out the best of which the most skilful workmanship is capable. It is believed that the "WESTCHESTER COUNTY MODEL," built at the factory of THE MOBILE COMPANY OF AMERICA, is not excelled in strength, durability and excellence of design.

WHAT THE MOBILE IS.

The "WESTCHESTER COUNTY MODEL," built by THE MOBILE COMPANY OF AMERICA, is a horseless carriage weighing less than five hundred pounds, and costing but six hundred and fifty dollars. Compactly built, with workmanship of the finest quality, capable of traveling twenty miles or more an hour and reducing its speed so that it can take its place in the slowly moving and stopping line of travel in the great cities, it is operated by steam under circumstances which render it absolutely safe. More than a thousand Stanley carriages of the Massachusetts model are now in public use, and there has never been a single boiler accident. The fuel shuts off automatically when the steam reaches one hundred and sixty pounds. There is a safety-valve which opens at one hundred and seventy pounds. Each boiler is wound with piano wire and tested up to six hundred pounds pressure, and is calculated to withstand a strain up to thirty-five hundred pounds pressure to the square inch. Recently, as an experiment, a boiler was placed in an excavation, all valves closed, and the fire turned on full head. A gauge carried off to a distance showed a steam pressure of twelve hundred pounds. Then the steam began to drop, owing to a slight escape around the head of each of the copper tubes which compose the boiler flues, and the pressure did not rise above the twelve hundred pounds indicated, until all the water was exhausted. If the water

ADVERTISING SUPPLEMENT.

NORTH END MOBILE COMPANY'S FACTORY.

supply should be exhausted in the boiler through oversight, the pressure drops and the boiler ceases to produce stèam, and with the decreased pressure of the steam the carriage comes to a stop and the pump which supplies water ceases to work.

REGARDING THE PRICE OF $650.

The factory of the company has been fitted up with the most perfect machinery and special tools, all new and of the latest design for manufacturing on the most extensive scale. In this way the company proposes to bring the price within the reach of every class. The charge made is SIX HUNDRED AND FIFTY DOLLARS, payable upon delivery at the Kingsland Point station of the New York Central Railway. The claim made for THE MOBILE COMPANY'S "WESTCHESTER COUNTY MODEL" is that it has no superior in the world's markets to-day.

THE MOBILE'S RADIUS OF MOTION.

One of the improvements in the "WESTCHESTER COUNTY MODEL" is a tank made from seamless copper tubing, giving a fuel-storage capacity double that in the original Stanley carriage, and equal to one hundred miles' run on smooth, level roads. The MOBILE can travel over any class of road, rough or smooth; but it must be distinctly understood that the rougher the road the more fuel required.

THE MOBILE BUILT TO CLIMB THE STEEPEST HILL ROADS.

The question of steep grades is an annoying one for the average horseless carriage. Not so for the MOBILE. It can climb on a fairly made road up a fourteen per cent. grade (which is considered a pretty steep country road) at the rate of fifteen miles an hour. During last summer, Mr. Freeland O. Stanley and his wife ascended the long, steep road up Mount Washington in two hours and twenty minutes.

IN THE MATTER OF COMFORT.

The MOBILE is perfectly smooth in operation. It moves without a jar or vibration of any kind. When in motion, the products of combustion are carried underneath the carriage, and neither heat nor odor of any kind arises. The machinery is noiseless except in climbing stiff grades, when a slight puffing is audible, but nothing in the least degree objectionable.

There are more than a dozen improvements in the present carriage over the Stanley carriage as originally put out. The first and most important of these is in the engine. The second relates to the gasoline tank, which now holds double the quantity of oil formerly carried. A seamless copper tube, very strong in construction and elliptical in shape, secures this much-to-be-desired result.

Another marked improvement is in the ball bearings of the engine, which are one-half inch instead of three-eighths inch, as formerly, experience showing that the increase of strength thus obtained is an item of great importance.

The other improvements are largely in details of construction, no effort in time or money having been spared to work out the most perfect results.

The question is frequently asked, "What guarantee is given to the intending purchaser?" To this we reply that we guarantee our materials and workmanship to be the best that money can produce. Our factory, however, is open to the inspection of intending purchasers, and it only needs a visit to the various departments to satisfy an expert as to the excellence of the work being turned out.

The claims which the MOBILE makes upon the public confidence may be briefly summed up as follows:

First. The lightest, most compact, best designed and most perfect horseless carriage now before the public.

Second. The highest class of materials and workmanship.

Third. Cost—but $650.

Fourth. Simplicity in construction, odorless when running, and almost noiseless.

Fifth. It can speed at a gait up to thirty miles per hour or follow the slowest truck.

Sixth. It is operated by steam, the standard power of the world, under perfect regulation and test.

Seventh. Its fuel is inexpensive; it carries a supply for fifty to one hundred miles, according to the character of the road, which can be procured at any drug store at slight expense.

Eighth. It embraces all the latest improvements, and is confidently recommended as the most perfect piece of machinery now on the market.

The probabilities are that not one automobile carriage will be built during the coming season where

ADVERTISING SUPPLEMENT.

ten will be required to supply the demand. The impression prevails that there are a great number of horseless carriage factories being erected and that the output will be large during the coming season. The fact remains that there are not in operation in the United States at this time factories capable of turning out twenty machines a day other than the Stanley carriage. After three years of experiment on the part of the Messrs. Stanley and nine months spent on the construction of a factory, we are only now in a position to turn out carriages on a considerable scale.

A carefully prepared book of instructions will be furnished with each carriage sold, and it is possible for any one with some mechanical knowledge to master the handling of the MOBILE from the instructions therein given. Unmechanical purchasers living at a distance who cannot come to the factory for instructions are advised to secure a careful and competent engineer, a man of good judgment and likely to be thorough, who can master the machine and then instruct the purchaser.

INSPECTION OF VEHICLES.

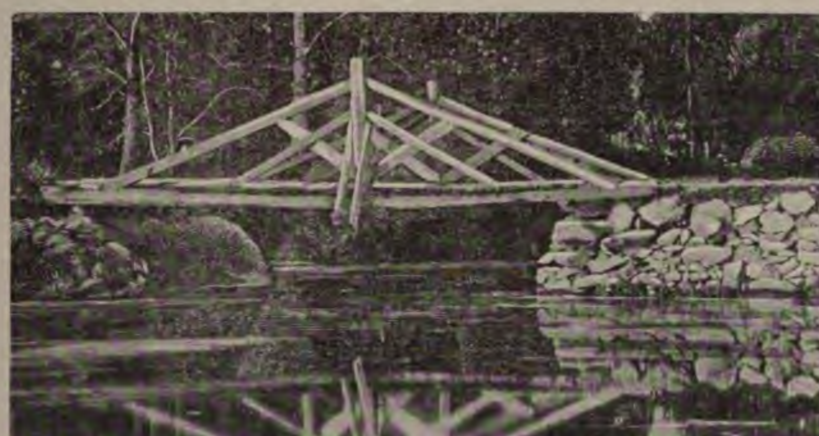
The MOBILE carriage, "WESTCHESTER COUNTY MODEL," may be found from 9 A. M. to 6 P. M. in front of the New York offices of the company, Fifth avenue and Forty-second street, and Times Building.

Intending purchasers are invited to visit the factory at Kingsland Point, Tarrytown-on-the-Hudson, where instruction will be given in handling the carriage.

KINGSLAND POINT WELL ADAPTED FOR TRYING AUTOMOBILES.

The Philipse Manor property contains many beautiful roadways, steep, level, good, and some bad, so that the purchaser or intending purchaser will find it admirably adapted as a place to try automobiles.

Tarrytown is a little more than half an hour's run from New York by the fast trains. Of the fifty-nine accommodation trains which stop at Tarrytown station, fourteen each day stop at Kingsland Point upon application to the conductor. Kingsland Point itself is considered to be one of the two or three most beautiful places on the Hudson. It stands well out in the Tappan Zee, with Grant's Tomb visible on a clear day to the south, and a great stretch of water to the north off into the Highlands. The place is full of historic memories. The original Philipse Manor and mill, more than two hundred years old, are still standing. The "Headless Horseman's Bridge" is near by. The mansion was the center originally of the Philipse estate, which embraced two hundred square miles and reached from Spuyten Duyvel to Peekskill. It seems proper that here should be opened the manufacture of automobiles, for here were begun more than two hundred years ago manufacturing operations on the Hudson.



THE HEADLESS HORSEMAN'S BRIDGE AS IT WAS FORMERLY.

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Any of our subscribers who are willing to solicit subscriptions for THE HORSELESS AGE from their fellow townsmen are requested to communicate with the Editor, as we are desirous of entering into business relations with such parties.

THE HORSELESS AGE

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. VI. NEW YORK, APRIL 25, 1900. No. 4.



THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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HERBERT LADD TOWLE, Associate Editor.

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COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week s notice required for discontinuance or change of advertisements

THE HORSELESS AGE, 150 Nassau Street. New York.

Entered at the New York post-office as second class matter.

**On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.**

The date of the Acetylene Motor Number has been changed from May to June.

## The Public's Rights.

The recent action of the Prefect of Police in Paris, organizing a brigade of bicycle policemen to regulate the speed of automobiles there, is only another indication of the lengths to which reckless and irresponsible drivers of these machines may go. We do not speak of the accident in the Paris-Roubaix race, in which two contestants became entangled and dashed off the course into the crowd which was watching them. In a speed contest it is understood that the participants will drive their machines to the utmost, and if the spectators take chances, so do the racers. But too much is heard of thoughtless drivers who run their machines at a speed where the slightest slip or diversion of attention may result in an accident much more serious to its victims than to the machine or its driver. Doubtless the spectators of these evolutions do not appreciate how completely the vehicle is under the control of its driver, just as many were wont to complain when bicycle riders whizzed by them within a foot or two. The bicycle rider knew what he was about, and he usually also knew what the pedestrian was about, and he could calculate his speed and course for both. But even the bicycle rider takes the chance of a loose stone or a slippery spot in the road; and it is constantly apparent that the driver of the motor carriage needs nothing so much as alert and unremitting presence of mind. The machine indeed responds instantly to a movement of the lever; but it is only too easy for the driver to become confused in an emergency and to move the lever the wrong way.

Beginners in the art of managing horses are apt to be somewhat timid, because they know that the horse has a mind of his own, and the main question is whether the horse's mind or his driver's shall have the supremacy. There is no such uncertainty attaching to the machine, and the user of the latter is apt to forget his own limitations in the sense of power which he feels in controlling his mount.

## The Place for the Differential.

The Mees carriage, illustrated by us on another page in this issue, is a good example of the driving arrangement usually employed on the other side. The usual construction in this country, with the rear axle made a driving member and the differential gear mounted on it, is suited only to comparatively light work. For large powers the torsional strain on the axle becomes so great when the motor is in the slow-speed gear that the axle itself must be made of extravagant dimensions to withstand it. The use of a high-speed countershaft, split for the differential, and driving the rear wheels independently by sprockets or gears on each wheel, admits of much lighter construction, and is, we believe, destined to receive more attention than heretofore on this account.

## Right or Left Side?

There is considerable diversity of practice among builders of motor carriages in regard to the place of controlling levers, etc., for the driver. In England the custom is, we believe, to

put these on the right-hand side. But in England, the rule of the road is to turn to the left; and it would appear that the reason for the above custom is to place the driver where he can best watch his course with reference to other vehicles. In a crowded street, or when running fast, it is often necessary to watch the wheels carefully to see that the hubs of passing vehicles will not collide. On this account it would appear most logical in this country for the driver to be seated at the left, and there seems little doubt that it is the more advantageous position.

## His 'Prentice Hand.

Columbus, O., evidently believes in going slow. Director of Law Crum, of that city, has submitted an ordinance restricting the speed of all vehicles, both horse and horseless, and of bicycles, to 6 miles an hour on any street, avenue, alley or other public thoroughfare. Other sections of the ordinance require that lamps be carried, and prohibit scorching, serpentine riding and the riding of bicycles without at least one hand on the handle bars. Liberal penalties are provided for the infraction of any of the regulations.

## Blowing as a Fine Art.

The Anglo-American Rapid Vehicle Co. is living up to the well-established reputation of its directors. One of the latter is quoted as having talked as follows to a newspaper reporter:

"I expect to see the day when men of Philadelphia will do business regularly in New York. They will ride over in the morning in their private carriages and return in the afternoon. The trip one way will take less than an hour. Their automobiles will have flanged rubber wheels, and will travel on the tracks of the Pennsylvania Railroad or on tracks laid especially for them. Ninety miles an hour will be no speed at all when the art of automobile making is once understood. The day is not far off when a speed of 100 miles an hour on an ordinary dirt road will be easily made. On steel rails the speed will be almost double that."

## The Significance of the Race.

As some communications have come to us regarding the showing made by the several contestants in the Automobile Club's race on the 14th, we may properly remark here that, to our perception of the matter, such a race proves nothing beyond the relative speed of the particular vehicles or classes of vehicles engaged. We have no wish to detract from the credit due the winning carriage, whose performance was as excellent as it was unanticipated; but that carriage was built especially for racing purposes and is reported to be intended for entry in the Gordon Bennett Cup race. The other machines were of standard pattern, without additions for the purpose of gaining speed, and their successful performance is certainly a thing on which their builders are to be congratulated. The time made was not at all remarkable as racing speeds go, since gasoline machines in France have been driven over half as fast again for double or treble the distance. The Automobile Club's first race showed what could be done by pleasure carriages of ordinary types; and the winning of the race by a few minutes more or less was a matter of much less importance than the creditable performance of the remaining competitors.

## Paris Rebels at Last.

The abuse of their privileges by automobilists in Paris is leading to a decided uprising of popular opinion against them. Accidents and even fatalities are almost of daily occurrence. Often indeed the riders themselves have suffered most, but in many cases the machine has found victims in pedestrians or in other vehicles.

It appears that the peasantry were the first to rebel. Then a well-known novelist, Hughes Leroux, after his wife and child had narrowly escaped being run down, wrote a long letter to the Figaro announcing that in view of the failure of the police and the courts to deal with the nuisance he would shoot the first chauffeur endangering him. Two weeks later he fired his revolver twice after an individual whose charge he just escaped. He missed and was not molested. Now the general public has been thoroughly aroused by an accident to a woman, Madame Bos, and several prefects have forbidden road races through their departments. It is even intimated that the Paris-Bordeaux race and the Gordon Bennett contest will be impossible.

The Prefect of Lepine has organized a bicycle police squad, which on the first day of its work arrested 30 scorchers.

## Automobiles for Russian Army.

Consul-General Holloway writes to the State Department from St. Petersburg that the Russian Minister of War is desirous of purchasing a freight automobile, to be propelled by either steam or kerosene, and proposes that if any manufacturer will ship two such carriages, one for steam and the other for kerosene, to St. Petersburg, the War Department will pay the freight and duty on both, purchase the one better suited for its purpose and return the other. The machines are to be in St. Petersburg by June, 1900.

Manufacturers are asked to send catalogues, giving weight, inside dimensions, price, rapidity of movement and other data to Col. N. A. Blinoff, chief of staff, Ministry of War, St. Petersburg, Russia. Mr. Holloway suggests that the possibility for large orders to supply the Russian army, which is scattered over an area more than twice the size of the United States, with automobile wagons, is worthy of attention.

## A Judgment Reversed.

Jonathan West, of Rochester, N. Y., who was sued by the proprietor of a laundry in that city for damages resulting from the frightening of a horse by Mr. West's steam carriage, has obtained a reversal of the judgment rendered against him in the municipal court. The appeal was argued before County Judge Sutherland, and in his decision the Judge says: ,

If one should find it desirable to go back to primitive methods and trek along a city street with a four-ox team and wagon of the prairie schooner variety, it would probably cause some uneasiness in horses unused to such sights. Yet it could not be actionable, in my opinion, if a runaway should result, provided due care were shown not unnecessarily to interfere with the use of the highway. Horses may take fright at conveyances that have become obsolete as well as at those which are novel; but this is one of the dangers incidental to the driving of horses, and the fact cannot be interposed as a barrier to retrogression or progress in the method of locomotion. Bicycles used to frighten horses, but no right of action accrued. Electric street cars have caused many runaways. Automobiles operated without steam by storage batteries or by gasoline explosion engines, running at a moderate speed, may cause fright to horses unused to them, yet the horse must get used to them or the driver take his chances.

It will not do to say that it is proper to run any kind of a contrivance upon the street in which persons may be carried. A machine that would go puffing and snorting through the streets, trailing clouds of steam and smoke, might be a nuisance, but this is not such a case. The temporary inconvenience and dangers incident to the introduction of these modern and practical modes of travel upon the highway must be subordinate to the larger and permanent benefits to the general public resulting from the adoption of the improvements which science and inventive skill have perfected. The judgment appealed from is reversed.

## Some Corrections.

In the last paragraph but one of L. Berger's article on "Poppet Valves," in our last issue, the expression for the lift of the valve should have been printed:

$$\text{Lift} = S = \frac{\pi\, d^2 \times 19}{55.6 \times \pi\, d} = \tfrac{1}{8} \text{ in. nearly.}$$

The last portion of the stroke, neglecting the resistance of the carbureter, is

$$l_1 = l \times \left(\frac{1.56}{14.7 \times 1.62}\right) = 0.0652\,l.$$

The formula for the piston's motion for a given crank angle is

$$l_n = r \text{ vers } \alpha \pm L \text{ vers } \theta$$

in which

$r$ = the length of crank.
$\alpha$ = the crank angle.
$L$ = the connecting rod length.
$\theta$ = the connecting rod angle.

Here $r = \tfrac{1}{2}l$; and if we assume $L = 2l$ the above works out to about 33 degs. for $\alpha$. $\theta$, which is best found graphically, is about 8 degs.

The Goodyear Tire & Rubber Co. has recently established a branch factory at 1557 Broadway, New York City.

## A New Aluminum Alloy.

An alloy of aluminum which is coming into use in France for vehicle motors is called Cothias Metal. It approaches aluminum in lightness and is of a grayish color, but in hardness and tenacity it resembles 50-point steel. It can be worked without difficulty and has excellent anti-friction properties. It is cast under pressure in steel molds and it comes out the exact size of the mold and perfectly smooth, so that no machine work is ordinarily necessary on it.

## A Hint for Mr. Winton.

The motors of the Panhard-Levassor racing machines are provided with both jump spark and tube ignition for each cylinder, with the object of securing the utmost certainty of ignition and speed of inflammation. This combination will be used on the motors of that make in the Gordon Bennett Cup race.

## The Century Motor Vehicle Co.

The Century Motor Vehicle Co. has been recently incorporated at Albany to manufacture motor vehicles propelled by steam, electricity and gasoline.

The incorporators are Chas. F. Saul, president; Chas. Listman, vice-president; Chas. A. Bridgman, secretary-treasurer; H. C. Plumb, and Wm. Van Wagoner, manager. The machines will be manufactured under the patents of the latter.

Mr. Saul and Mr. Bridgman were respectively president and secretary-treasurer of the Barnes Cycle Co. before the business was sold to the American Bicycle Co. Mr. Van Wagoner was general superintendent of the Barnes Cycle Co. and remained with the American Bicycle Co. until March 1, when he resigned his position to perfect the organization of the Motor Vehicle Co.

The company has engaged a corps of skilled mechanics, and it is their intention to employ none but the most skilled workmen and use the best of material. They have leased a manufacturing building at 519 East Water St., Syracuse, N. Y., which they are rapidly equipping, and have a number of vehicles on the floor and in course of construction. We illustrate their electric Stanhope No. 1, and it will be seen that the mothod of power transmission is, for this class of vehicle, something of an innovation. Instead of driving the rear axle by single reduction spur gearing, the motor is suspended from the forward part of the body, with its shaft in line with the carriage, but sloping downward and back in the direction of the rear axle. A spur pinion and gear connect the motor with a shaft running back to the rear axle, and a bevel gear on the differential drum.

The battery is of 42 cells, arranged in six trays, and the connections to the controller allow of three speeds forward and three backward. The battery is charged with the controller at zero.

The same method of transmission is used likewise in both the steam and the gasoline vehicles built by this company. The steam motor is of the usual two-cylinder type, reversible and double-acting, and it is suspended from the body on

pivotal bearings on a similar plan to the electric motor, with the engine shaft coupled direct to the gear shaft which drives the rear axle. The driving mechanism and engine are entirely inclosed and dust proof. The gasoline vehicles have the engine arranged inside the rear of the body, and the changeable speed gear is pivoted to the body, transmitting the power to the rear axle by means of a gear shaft and bevel gears, similar to that used in the other two styles of vehicles. These also are dust proof.

The frame of all the vehicles is constructed of seamless steel tubing and forgings, and is made flexible to allow for inequalities in the road. Ball bearings are used throughout. The running gear is made by the company from their own designs. All the vehicles are steered and the speed controlled by means of one steering lever. The band brake is operated by a foot lever. The majority of the vehicles will be fitted with wire wheels and pneumatic tires, although in special cases delivery wagons will be fitted with wooden wheels and solid rubber tires.

Richard Croker is said to be interested in the Anglo-American Rapid Vehicle Co. Mr. Croker's connection with the New York Auto-Truck Co. will be recalled in this connection.

## The Suppression of the Reach.

By P. M. Heldt.

It is a well-known fact that after a certain experimental period in the history of a mechanical industry the types of machines produced by the various manufacturers approach each other in the general lines of their construction. Experience proves certain forms and constructions the most suitable and practical for the purpose they are intended to serve, and they are adopted by the majority of manufacturers.

The automobile industry has not yet reached a point where such an approach is noticeable, as the styles of vehicle produced at the present time show the greatest conceivable divergence in their make-up. One individual takes a bicycle, and places a gasoline engine on the front fork, in the place of the crank case, or elsewhere, seeking to solve the problems of automobile locomotion by starting out in this manner, while some one else starts out with a horse buggy. The previous experience of the builder has in every case considerable influence upon the forms he gives his vehicles, and as persons from all possible trades are entering the industry, considerable divergence might be expected.

As more experience is gained in the automobile line, faulty constructions will be eliminated and a greater uniformity of

THE CENTURY ELECTRIC STANHOPE.

types will thus be attained. An analysis of the merits and demerits of various forms of construction published in a trade journal ought to hasten the elimination of faulty constructions and the adoption of better ones, and thus accelerate the progress of the industry.

In the present article the writer desires to call the attention of the readers of The Horseless Age to the fact that in a number of gasoline road vehicles, built in France, the connection between front and rear axle known as the reach is entirely suppressed, and that this form of construction has certain advantages which warrant its imitation.

In most of the earlier forms of gasoline vehicles the engine was placed directly on the reach, which is the easiest way of disposing of a number of constructional difficulties. It was soon learned, however, that the placing of so much dead weight on the reach had a very disastrous effect on the life of the tires and wheels, and that it was very injurious to the engine itself. What somewhat retarded the adoption in general of the practice of fastening engine and transmission gear to the body frame was the opinion held by many that it was inadvisable to suspend the engine from the same springs that the body was suspended from, as this would cause so much vibration of the vehicle body that it would be very uncomfortable to ride in. This fear is now allayed, and in the greater number of gasoline vehicles the engine and speed-changing gears are fastened to the body. The vibration of the body it is sought to reduce by improving the engines in regard to balancing.

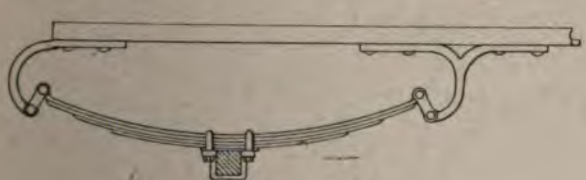


FIG. 1.

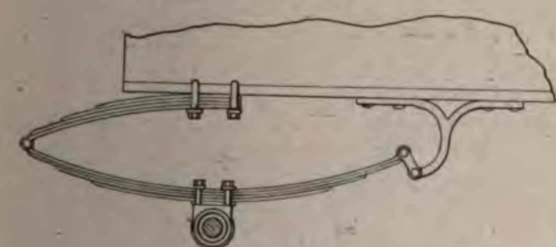


FIG. 2.

Vehicle bodies which have the engines and transmission gear directly attached are constructed with a metallic framework or skeleton. To this framework the springs are fastened. Semi-elliptic springs are used a good deal in France, which in connection with pneumatic tires give entire comfort.

The front and rear springs being connected by a strong metallic frame, there is thought to be no need for a reach. The weight of the reach can be saved and the body and machinery contained therein be placed proportionally lower, as there is no danger of striking anything when the springs are compressed. The fifth wheel found in most American automobiles is also done away with. The springs permit the wheels to adjust themselves to the level of the street under all ordinary conditions, and for extraordinary occasions, when one of the wheels drops into a depression in the road or has to go over large obstructions, the springs are strong enough to stand the resulting strain.

In Fig. 1 is shown a semi-elliptic spring, fastened at both ends by means of links to forgings riveted to the frame of the vehicle. Sometimes a link is only interposed on one end, the other end of the spring fastening directly to the forging.

Fig. 2 shows a form of spring sometimes used in the rear of vehicles. It has a somewhat greater resiliency than that shown in Fig. 1.

The advantages gained by the suppression of the reach are therefore reduction in weight and more freedom in placing the machinery.

## A Retrospect.

In the Aug. 30 and Sept. 20 (1899) issues of The Horseless Age I proposed rational formulas for the work of an Otto cycle gas engine, which I believe give results approximating those obtained in practice. As I did not know that any such formulas had been previously published, I compared the results they gave with such practical data as came to my notice for a year or two before offering them to The Horseless Age. Since then I have noticed some published observations that seem to have some bearing upon the subject.

As a fundamental equation I assumed the approximate formula:

$$(1)\quad P V^{\frac{4}{3}} = P_1 V_1^{\frac{4}{3}}$$

This may be put in the form: $\frac{P}{P_1} = \left(\frac{V_1}{V}\right)^{\frac{4}{3}}$

or $1.33\frac{1}{3} \log \frac{V_1}{V} = \log \frac{P}{P_1}$.

In the March number of Power an anonymous writer remarks:

"From measurements made of a number of actual diagrams the present writer has found the following pressure formulas to apply closely to average engines:

$$1.35 \log \frac{V}{V_e} = \log \frac{P_e}{P}$$

for ordinary engines, and

$$1.32 \log \frac{V}{V_e} = \log \frac{P_e}{P}$$

for scavenging engines."

This seems a very close agreement. In view of the nature of the subject matter the two (or three) formulas above given are practically the same

On page 160 of his book on "Gas Engines" Mr. Grover says: "'In round numbers, we may take it that the maximum pressure obtained will be 3.5 times the pressure before ignition."

This is precisely the same result that I obtained from theoretical considerations, and from this practical observation of Mr. Grover the formulas that I published might be directly derived.

On the next page Mr. Grover says: "There is a marked similarity between all indicator diagrams from gas engines, and from a comparison of a large number of diagrams it will be found that the mean effective pressure produced is roughly equal to 2 C — 0.01 $C^2$ when C = compression in pounds per square inch above atmospheric pressure."

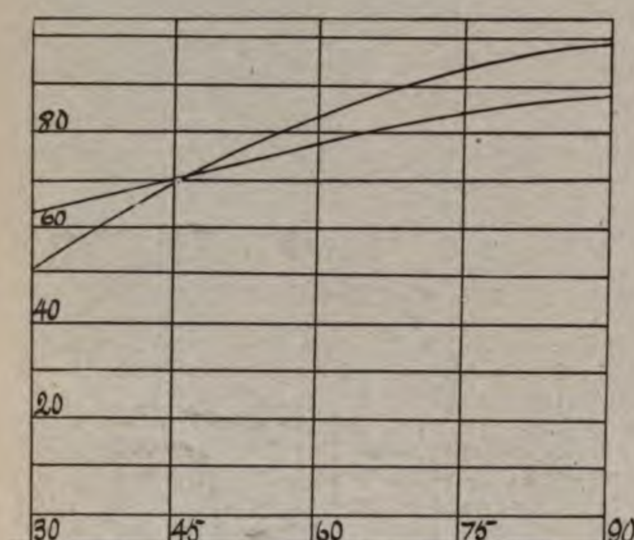
In the following table I have set down the gauge compression in the first column, the mean effective pressure as calculated by Mr. Grover's formula in the second column, and in the third column the same as calculated by the formulas which I published.

Mr. Grover remarks that his formula is only applicable up to a compression of 100 lbs. gauge. It may be noticed that the two values calculated come very close together at average pressures, say at about 50 lbs. gauge:

TABLE.

| Gauge Pressures. | Mean Effective Pressure. | |
|---|---|---|
| 30 | 51 | 62.1 |
| 45 | 69.75 | 70.4 |
| 60 | 84 | 77.8 |
| 75 | 93.75 | 83.61 |
| 90 | 99 | 88.3 |

In the following diagram the above table is illustrated graphically, gauge pressures being laid off horizontally and mean effective pressures vertically:




The increase in the mean effective pressure, with the increase of compression, with the same stroke, and approximately the same material, is to me somewhat startling. I am therefore inclined to favor the formula that gives the smaller variation until otherwise advised. The tendency all along the line has been to increase the compression, and a material improvement in the efficiency of the engine has resulted But I do not think the efficiency of the engine in the aggregate has been doubled.

An equation for the horse-power of an engine may easily be deduced from Mr. Grover's empirical formula. It is as follows:

$$\text{H. P.} = \frac{(2\,P_1 - 0.01\,P_1^2)\,(V - V_1)\,N}{66000}$$

I proposed the following:

$$\text{H. P.} = \frac{A\,V\left[\left(\frac{P_1}{P}\right)^{\frac{1}{4}} - 1\right]N}{600}$$

In both equations H P is the horse-power, P is the pressure of compression (by gauge in the first and absolute in the second), N is the number of revolutions per minute, A is the piston area in square inches, P is the pressure at the commencement of compression.

E. J. STODDARD.

[In a private letter Mr. Stoddard points out that if a value of 200 lbs. for the compression be substituted in Grover's formula for the mean effective pressure, a result of zero is obtained. It is evident that the formula is empirical and intended only for the pressures in common use.—Ed.]

## A New Friction Clutch.

We illustrate a friction clutch recently put on the market, which, while not designed for motor vehicle use, yet contains several features of interest.

A successful clutch must combine simplicity of construction with ready renewal of the wearing parts; it must take up its load gradually, and release it instantly and positively when required; it must contain provision for readily and accurately taking up wear. In addition it should be as compact as possible; centrifugal force should not be a disturbing element at high speed, and the gripping surfaces should be inclosed from the dust so far as practicable. It will be seen that the clutch shown is very efficient in all of these particulars, its simplicity and large gripping surface being particularly noteworthy.

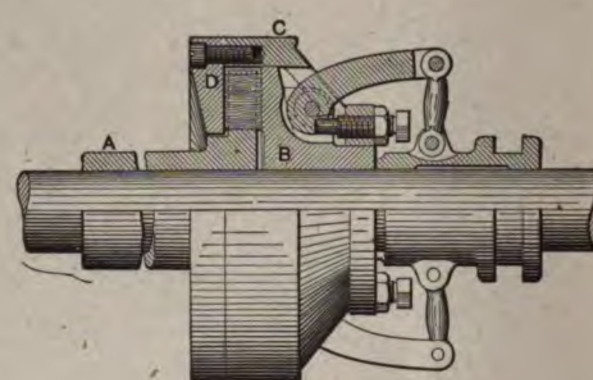



FIG. 1.

The half-section, Fig. 1, shows the clutch assembled on a single shaft, but in service the hub A is keyed to the driven shaft and B to the driving shaft, the relative positions being the same as in the cut. The hub A is flanged at its inner end and carries a series of circular wooden blocks, as clearly seen in the photograph showing the several pieces of the clutch. Both ends of these blocks are gripping surfaces, one bearing against the flanged face of B, and the other against the follower or gripping plate D, which revolves with B. The levers are pivoted between ears cast on the driver B, as seen at the right in Fig. 3; and they engage the ends of the adjusting screws shown. These screws are threaded into the hub of the shell or cover C (see foot of Fig. 3); and the shell

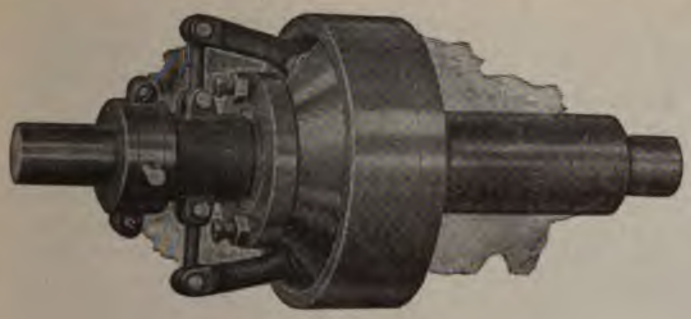


FIG. 2.

itself slips over B, which drives it by engagement of its ears with the edges of the apertures where the levers come through; and the plate D is screwed to C. When the levers are spread, by moving the sleeve and toggle links into the position shown, the adjusting screws, shell C and plate D, are together forced to the right until D presses tightly against the wood blocks carried by A. A also, by virtue of the end play of the two shafts, is moved slightly to the right until the blocks press against B; and the clutch is then in engagement.

It will be seen that the clutch is practically dust proof; also that the adjusting screws are protected by the levers so that there is no danger of their catching in anything when revolving. Centrifugal force can never interfere with the action of the clutch, and the wood blocks can readily be renewed when worn by taking off the plate D and slipping the shell C to the right.

If desired the hub A can run loose on the shaft and have a pulley keyed on it. In this case it is usually bushed with phosphor bronze or metalline.

This clutch is manufactured by the Whitman Mfg. Co., 39 Cortlandt St., N. Y., and, like their patented gas engine clutch, is called by them the B. & C. clutch.

## As to Igniters.

One of our correspondents, who has tried both the make-and-break and jump-spark igniters, prefers the latter. He writes:

"It certainly promises to give far less trouble than any make-and-break arrangement. It is of course more expensive to put up, as the induction coil has to be very carefully made and costs fully $25. The strength of battery and time of contact have to be adapted exactly the one to the other to get even fair results. It is my opinion that the small air-cooled motors, on account of their quick running and extreme heat, will spark with a very much weaker and simpler arrangement than the rather elaborate and heavy one we use. * * *

"The great advantage of the jump spark is that less than half the amount of battery can be carried, and the moving contact points inside the cylinder give no trouble. I have

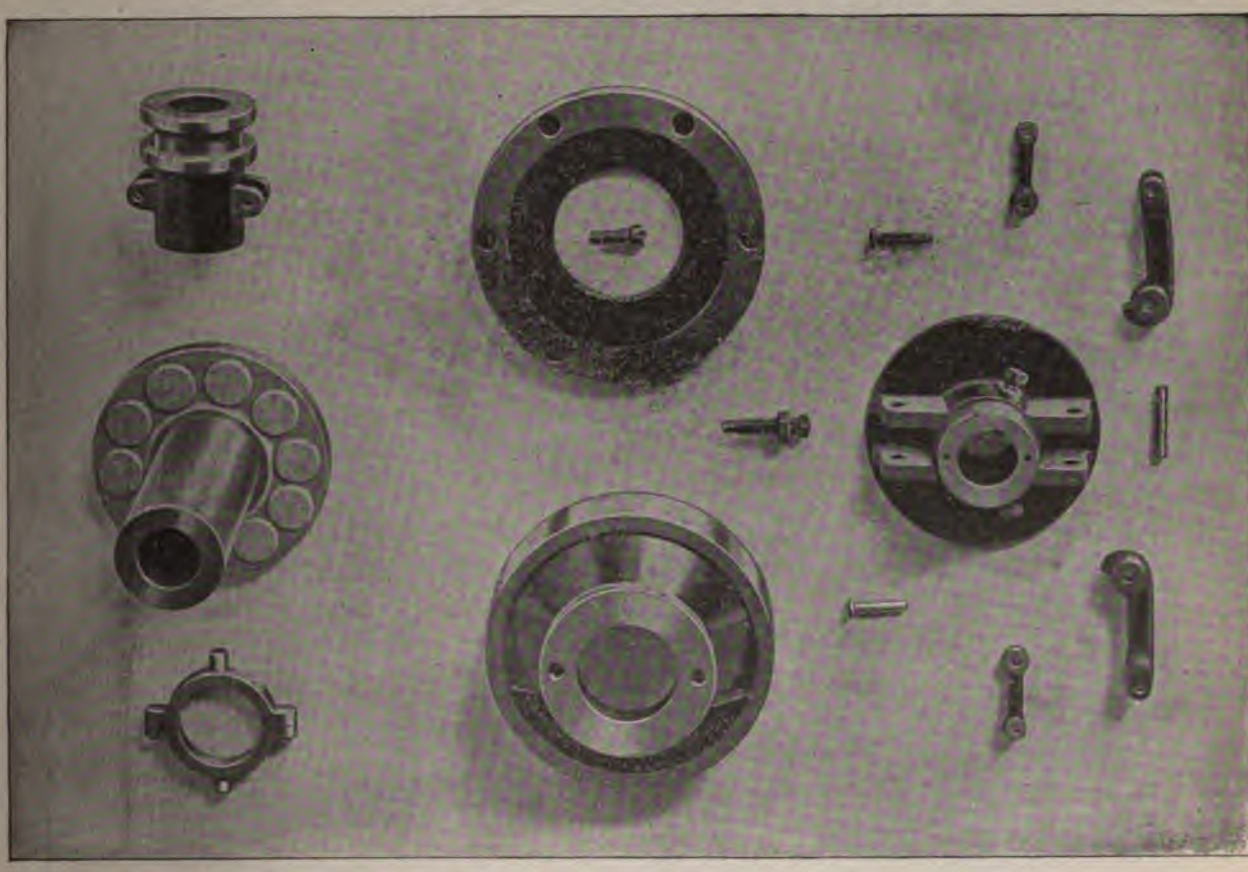


FIG. 3. PARTS OF THE B. & C. CLUTCH.

so far had no trouble with sparking plugs, and if these should give trouble it is no trouble to replace them. An extra one should always be carried. We are at present making our own coils, not having found anything even half way decent on the American market."

## The Aster Motor in this Country.

We show a photograph of the motor tricycle manufactured by the Waltham Mfg. Co., Waltham, Mass. It is fitted with the Aster motor, which was described in our issue of March 28. The Waltham Co. send us the particulars of numerous records made by the Aster motor in France. Among them are: One hundred kilometers by a tricycle with "avant train" in 2 hours 44 minutes; kilometer record, 57 3-5 minutes; Paris to Brest and return (1,200 kilometers), record made by Terrent in 40 hours 4 minutes; motor cycle cup race of the Automobile Club of France, 100 kilometers in 1 hour 46 minutes.

The Waltham Mfg. Co. will shortly open a "Motor Accessory Department" at 424 Massachusetts Ave., Cambridge, Mass., which will carry a complete line of Aster motors, carbureters, batteries and other accessories, which they will sell at both wholesale and retail. While they will sell complete vehicles also from that department, the chief business will be as above. They will open the department May 1.

## COMMUNICATIONS.

### The Boiler Safety Device.

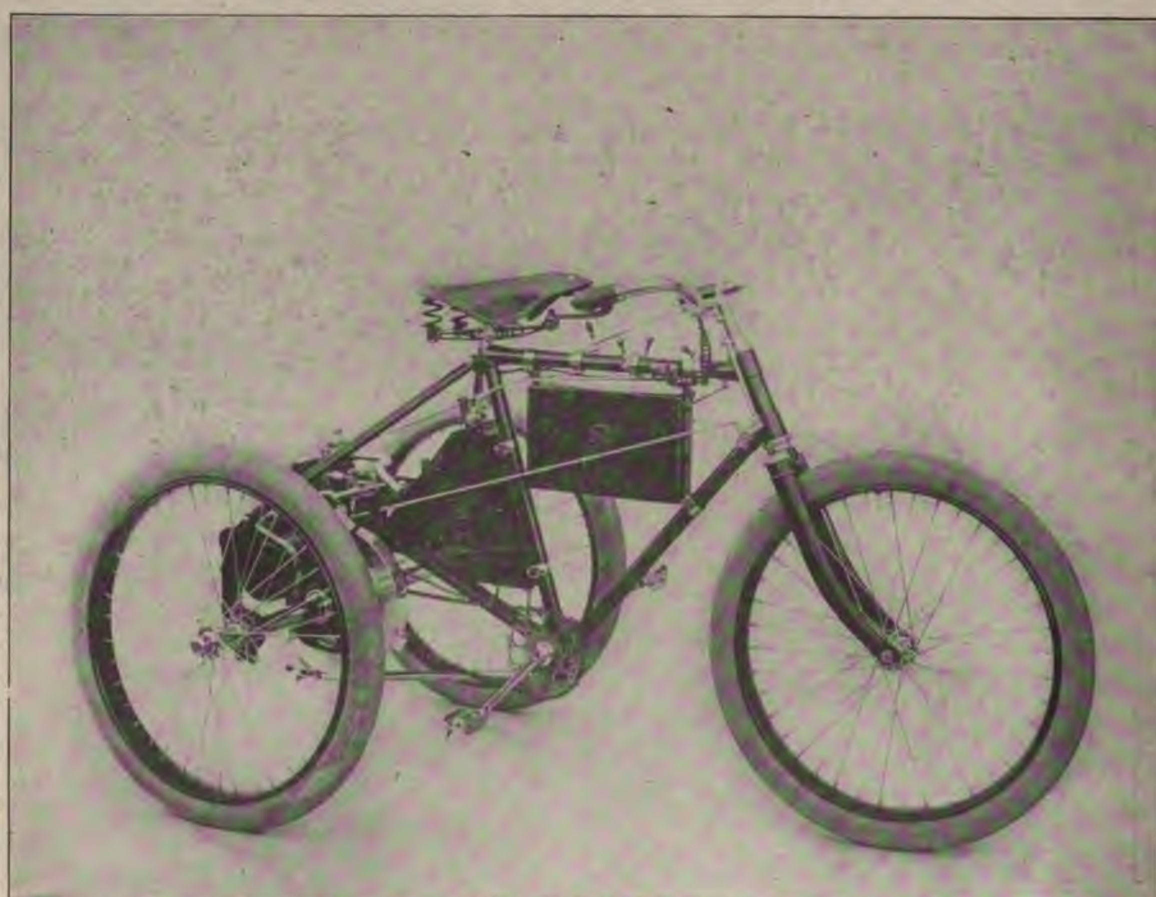
Salem, Mass., April 16.

Editor Horseless Age:

In your issue of April 11 I note a comment from Mr. T. F. Ahearn, of the Locomobile Co., on the "New Safety Device for Steam Carriaiges"; also a comment in answer by H. L. T. presumably of your paper. As I am somewhat responsible for the introduction of the device in question, and as the same has been found operative, I feel constrained to answer the comment of the gentlemen referred to.

I agree with Mr. Ahearn that the plug might fuse under operating conditions, but only in case the pressure was allowed to rise so that the temperature of the steam equaled or exceeded the temperature required to fuse the metal. In such a case the device becomes a safeguard against high pressure, as the fusing point of the metal is but a few degrees above the temperature of the steam at normal pressure. (It may be set at any point.)

On the other hand, the metal will fuse when exposed to the steam alone, as the tube holding the fusible metal will accumulate sufficient heat to fuse the same as soon as the end projecting into the boiler is uncovered, due mainly to the fact that there is no agent adjacent to absorb this heat, as had



THE WALTHAM MFG. COMPANY'S MOTOR TRICYCLE.

been the case when the water was circulating about the end of the tube; the small annular space between the sleeve and the tube being sufficient to prevent the heat imparted to the tube from being absorbed before it reaches the metal by the water surrounding the lower part of the sleeve. Naturally there would also be a tendency to higher steam pressure, consequent upon higher temperature, on account of the small amount of water in the boiler, allowing that the fire remains at or above normal. Of course, if the fire be practically shut off or turned nearly out, by the operation of the automatic burner control, the temperature will fall away below normal and no damage will result, whether the plug fuse or not; but I understand that most carriages are made so that the normal pressure is maintained at all times.

I trust you will restore the "New Safety Device" to its position as an "Operative Device." Yours truly,

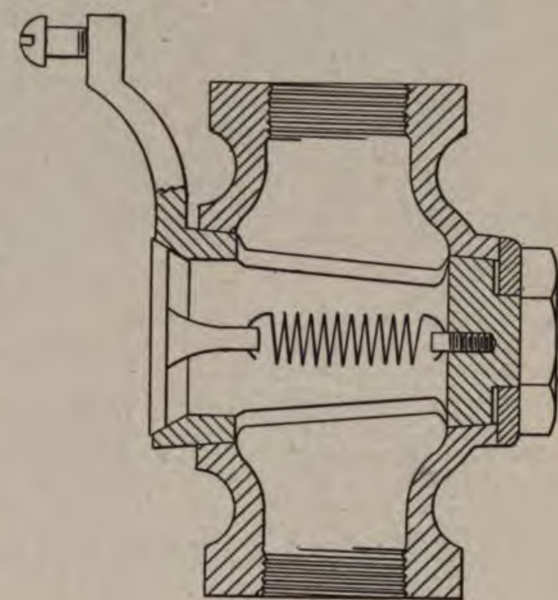
J. H. BICKFORD.

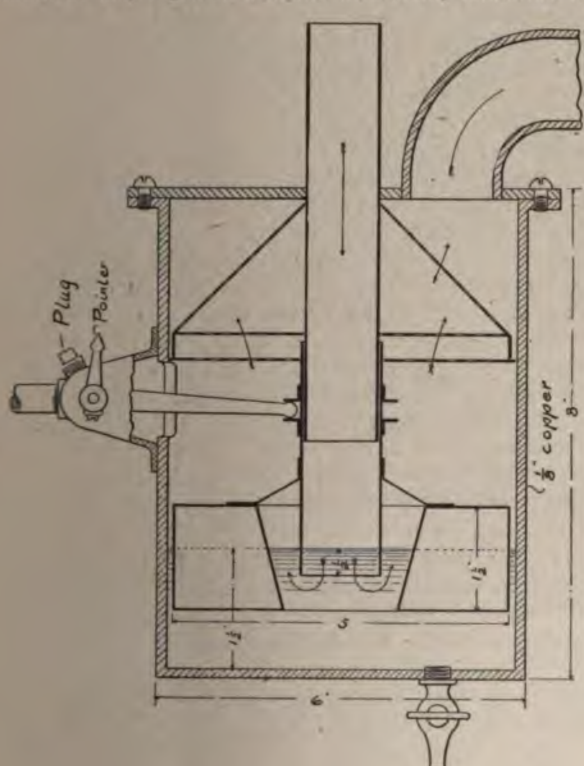
## More Facts.

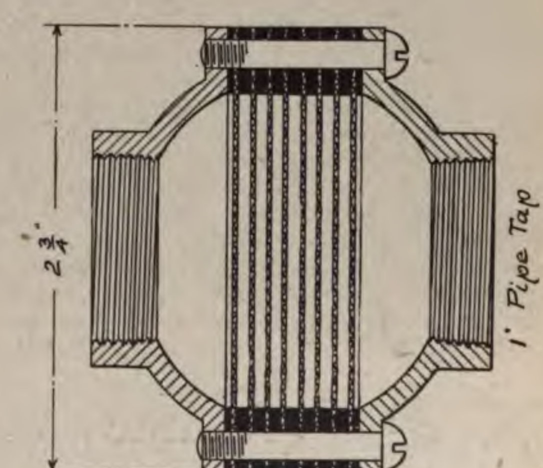
Buffalo, N. Y., April 7.

Editor Horseless Age:

There appeared in your issue of the 28th an article under the head of "Facts and Kinks," by E. N. B., of this city; and while there is no doubt of the kinks, the facts need straightening out. The fire check, relief valve and carbureter E. N. B. mentions were designed by and built under the writer's supervision. As he operated this particular vehicle 95 per cent. of all it ever ran with these attachments, he feels disposed to give the facts. The fire check consists of two brass flanges, as per sketch, with sufficient diameter to allow proper area through wire cloth. The space between can be filled with metal, fiber or even thick pasteboard. Fiber is best, and should be cut, together with the wire cloth, somewhat large, and after bolting together it can be turned off to make a good finish. The relief valve and throttle were combined in one piece, the result of not having more room. This was made from a common three-way cock which throttled the gas to both cylinders evenly, the top of the plug being made into a relief valve, as shown by sketch. The mixing valve was also made from a three-way cock, with the plug so arranged that the opening to the motor was always open. When the air port was open the gas port was closed and vice versa. This gave the same area of opening all the while, but a slight movement would give more air and less vapor.






The larger sketch gives main particulars in regard to the construction of the carbureter, which E. N. B. says gave fair results. If the rest of the carriage had given fair results it would probably be running to-day in place of being laid to rest as it is. In designing this carbureter the writer endeavored to produce one that would not be affected by a slight change in the quantity of the gasoline, and to keep the end of inlet tube under a constant seal it was carried by the float and placed in the center so any considerable inclination of the carbureter

due to the carriage not being level would have very little effect on it. The telescope tube kept the float in position and free from injury.

The amount of gasoline carried was regulated by the position of the cock in relation to the arm, and by removing the plug access was had to the clamping screw. The pointer served its purpose well and was simply a convenience in showing at a glance that the float was properly attending to its work. The perforated plates were to assist in the evaporation and prevent liquid from being spattered into opening to motor. The warm air supply should be taken from around the exhaust pipe and the area of the sleeve should furnish sufficient heat to just make up for the cooling effect due to the evaporation. A telescope tube with a clamp screw to adjust the heating surface will enable the beginner to determine the proper amount. The air inlet to mixing valve should have a pipe at least 6 to 8 in. long, as the inertia of the vapor, when the valve suddenly closes, is sufficient to cause a considerable discharge and waste unless such tube is provided.

Such is a brief description of the above mentioned features. This particular carriage has been run by the writer over strips of rough paved streets in which the jolting was so severe as to cause the body to repeatedly strike the main frame. Even this rough work had so little effect on the carbureter that it was given no attention whatever. E. N. B. speaks of "a wheel coming off when 8 miles from home and a plank under the axle wired to the step made a slide that enabled the motor to drag the wreck slowly home." It is sure that the wheel came off, but part of the axle came with it. It was simply a case of broken axle, and while the wreck did mote home on a plank the motor in this case was the old gray horse and not the 3¼ x 4 in. two-cylinder motor, which was barely large enough to propel the carriage on a level. E. N. B. has overlooked the fact that even if the motors had been strong enough, with one wheel missing the differential was free to revolve without applying power to the remaining wheel.

On another occasion, in an attempt to go up an incline, utilizing a Pet Friction transmission, the motors ran through the trial without stop. No amount of coaxing with monkey wrenches or rosin would induce the friction to pull. In running the carriage home from this trial, and passing over a particularly rough piece of roadway, the front axle broke, throwing the writer's companion out and himself on to the dasher. Even this particular rough usage did not make the carbureter throw gasoline into the motor, for when we gathered ourselves together we found the motor still running, slipping the aforesaid friction. In view of the above showing, I fail to be convinced of the advantage of a plain tank over some recognized form of vaporizer or carbureter. Yours truly,

W. S. HOWARD.

## The Two-Cycle Gas Engine Defended.

Oxford, Mich., April 12.

Editor Horseless Age:

In the article by H. L. Towle in your issue of March 21 comparing the relative efficiency of the two-cycle and the four-cycle motor for vehicle propulsion, the writer very ably set forth the advantages and disadvantages of the two types as usually constructed. The objection that we see to his reasoning is that he seems to take it for granted that it is beyond engineering skill to overcome the objectionable features he points out in the two-cycle.

The comments on the article by W. S. Howard in your issue of April 4 were misleading for the same reason, for it must be conceded by all that with the objectionable features eliminated from the two-cycle engine, the four-cycle will scarcely be a competitor in vehicle propulsion, for then the two-cycle engine will be only half the size, the explosive impulses and vibrations one-half as great, and the balance wheel one-half the size as in a four-cycle engine of equal power, and it will start with greater ease.

These are the very points we are all aiming to obtain, as the ideal vehicle motor—ample power without vibration, bulk or weight.

There has never been felt before such a pressing demand for just such a motive power. The four-cycle engine has filled the requirements demanded by other industries fairly well, and the perfect development of the two-cycle has not been imperative; and with but few exceptions the two-cycle has been ideal only in matter of cost.

Now, in vehicle propulsion, within reasonable limits, the matter of cost is a minor consideration, and those who attempt the two-cycle engine for vehicle propulsion from the cheap standpoint are, I think, doomed to disappointment.

To make a perfect two-cycle of equal efficiency—that is, one that will actually develop twice the power that a four-cycle of the same size, weight and bulk will—and be certain and reliable in its action, as well as substantial and durable, we must not expect to produce it at a less cost than a four-cycle of the same size. Indeed, we may feel that we have accomplished our aim even if it cost a great deal more.

If our best engineering talent turn their attention to the development of the two-cycle, with this idea in mind, instead of cheapness, I think the difficulties will be surmounted.

We make a two-cycle engine especially designed for automobiles, and it may be of interest to some of your readers to note the methods by which we surmount some of the difficulties spoken of in the articles previously referred to. There are other points that we are not at liberty to publish now, but which we will give you soon in another article should you think them of sufficient interest to your readers.

The stroke in this engine is 4 in., and the piston begins to uncover the exhaust port when the piston is within ½ in. of the end of its travel. The crank is then passing so near its dead center that there is practically no efficiency left in the propelling charge that we exhaust. The motion of the piston is much slower while passing this center than while passing the upper center, because the connecting rod is describing a circle from a center on the same plane as the center of the crank and upon the same side of the arc the crank is describing, though at a greater radius, so that it actually takes considerably more than one-quarter of a revolution to open and close the exhaust port, a large part of which time the port is nearly wide open, and with no intervening valves at any time to retard the exit. The four-cycle exhaust is open only one-half of a revolution, and the flow is greatly retarded by the valve guarding the exit. Our exhaust has more than twice the area I have ever found in a four-cycle engine, so that we provide for a complete change of air at a much higher motor speed than the four-cycle engine does. We avoid mixing the incoming charge with the exhaust of the previous explosion, by admitting first a stratum of pure air, then the explosive charge. Both are projected in a solid

semi-circular column up one side of the inside of the cylinder to the cylinder head, which deflects it back on the opposite side of the cylinder toward the exhaust ports. Part of the pure air may mingle with the exhaust and be expelled with it before the port completely closes, as we find that with proper construction there is a syphon action of the exhaust that draws in fresh air in excess of that compressed in the crank chamber by the forward motion of the piston, so that there is actually less of the exhaust of the previous charge left in the cylinder than is left in the four-cycle engine, and what little there is left is close to the piston on the exhaust side of the cylinder; and by placing the spark near the inlet side of the cylinder head we get it where the explosive charge is sure to be pure and uncontaminated by the burnt products of the combustion of the previous charge.

With this construction the limit of speed with maximum efficiency is found only in the limit at which it is practical to run reciprocating parts, which is higher in this than in four-cycle engines, because all moving parts are crank motions, while in the four-cycle the exhaust valve has to be worked by a jerk cam motion in order to allow it to be seated three-quarters of the time of each cycle and open and close during the other one-quarter of the cycle. In this motor a full explosive charge is admitted or none at all, as decided by the governor, which is of variable speed and can be set while the motor is running, anywhere from zero to 1,200 or 1,500 per minute; and whenever an explosive charge is not admitted, a cylinderful of cold air is pumped through.

This is more convenient for the operator, and is, we think, much better in many ways than the throttle method of governing usually employed in four-cycle vehicle motors. In going down an incline the motor gives no power impulses at all unless the vehicle slackens its motion to a point below the governor speed, or you pull the governor up to a higher speed than the vehicle is running at; but the motor is pumping cold fresh air through the cylinder every revolution and cooling it off without calling in the aid of the water jacket or radiating fins, as the case may be, and much less water is required for cooling purposes (when water jacket is used in place of fins) than when the regulation is accomplished by varying the strength of the explosions.

C. P. MALCOLM.

[We do not think that many builders of four-cycle engines consider the matter of actuating the valves an important obstacle to high speed.—Ed.]

## Read The Horseless Age.

Attleboro, Mass., April 16.

Editor Horseless Age:

Will you please publish in the next number how the gears are fixed into the sprocket wheel on the rear axle so as to do away with the strain on either wheel as a corner is turned? Please state also whether a kerosene burner is efficient as a steam raiser. Yours truly, C. R. HANDY.

[There are two ways to accomplish this. One is to have the rear wheels revolve independently on the fixed axle and be driven by independent motors. The other is to divide the rear axle and interpose a "jack-in-the-box" or differential gearing. You will find the differential gear illustrated or referred to in almost any number of The Horseless Age. A modified form will be shown in the abstracts of patents next week. A modification of this arrangement is to put the differential on a countershaft, which drives the rear wheels by gears or sprocket wheels, one at each end. This construction is illustrated in the Mees carriage in this issue.

Kerosene is used for fuel in many steam launches and some steam wagons. The Lifu steam wagons illustrated in our issue of June 28, 1899, are an example.—Ed.]

## A Hydraulic Steering Device.

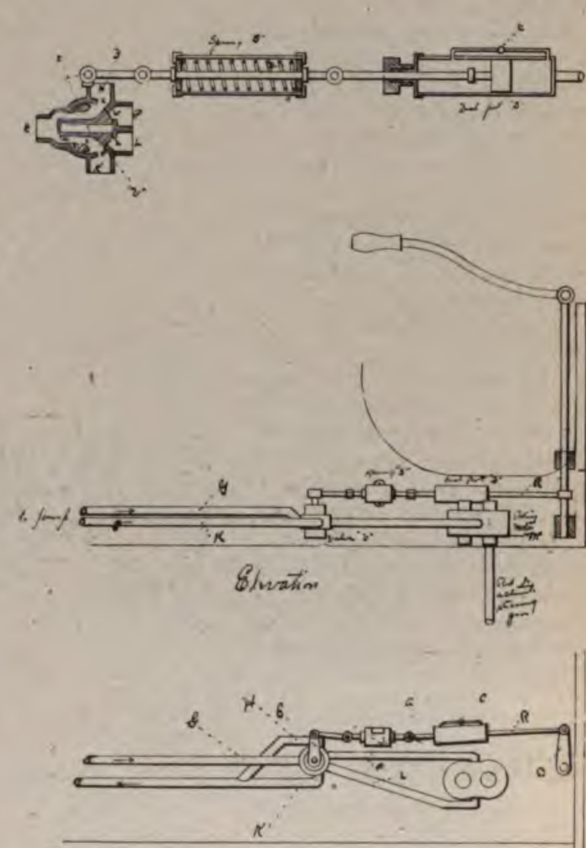
Berlin, Wis., April 13.

Editor Horseless Age:

As a contribution to the columns of your valuable paper I send you a drawing of a steering gear actuating mechanism, to which I attach the claim of originality.

Yours respectfully,

P. A. WAWZYNIAK.



EXPLANATORY REMARKS TO DRAWINGS.

The spring case S is firmly attached by suitable means to the carriage body, while the dash pot D is attached to the rod R, and is suspended between A and B.

A pump (not shown in the drawing) is coupled to the engine and keeps up a continuous circulation in the pipes G, K and H, as shown by the arrows. To guard against leakage a small reservoir of the liquid should be placed on the suction side of the pump, together with a check valve between the pipe and reservoir to prevent the liquid from being forced into the reservoir when engine is reversed. A small air chamber should also be placed on the delivery pipe of the pump.

The valve V is actuated by the steering handle through the dash pot D against the tension of the spring S, thus admitting pressure on one side or the other of the motor M. The valve must be provided with stops to prevent it from being thrown too far by the movement of the steering handle. The spring S is for the purpose of keeping the valve in its central position, and is compressed by rotating the valve either way.

The dash pot renders the steering natural, as though the steering handle were coupled directly to the steering gear. This is accomplished in the following manner:

The dash pot is provided with a by-pass and valve, C. The valve C is for the purpose of graduating the movement of the piston in the dash pot.

The arms E and B should be so proportioned that when the steering handle is moved through a small arc the valve V will be thrown wide open to the motor M. If now the steering handle be moved through a small arc in either direction and held still in that position, the valve V will allow a momentary flow of liquid through the motor M, which by its rotation operates the steering gear. It will be understood that the valve V will return to the middle of its vibration as soon as the liquid in the dash pot has had time to flow from one side of the piston to the other through the valve C. Therefore, under the above conditions the flow through the motor will be momentary.

In order to keep the valve V open to the motor M for a longer or shorter time, it is necessary to keep the steering handle moving through a greater or smaller arc.

In the sectional view of the valve V it will be seen that in normal position the liquid from the pump enters at G, passes freely through the valve and returns to the pump by H and K; also that when in this position the motor M is locked against rotation, for both of its ports are closed. Now, if the valve be rotated into either of the positions shown by the dotted lines X, Y, communication between G and H K will be cut off except by way of the motor. For instance, suppose the valve to be turned to the position X, then the port q will be brought in line with n and w, and t will establish communication between U and O, while the port Z will be closed. Therefore the liquid entering at G must flow through n q w, then through the motor and return through u t o to K. When the valve is turned to the position y the current will be reversed through the motor.

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The first woman in Baltimore to receive a permit from the Park Commissioners to run a steam carriage is Miss Mildred Gill. Miss Gill has run her carriage several hundred miles and thoroughly understands the management of it.

FIG. I. A MEES CARRIAGE WITH HOOD.

## OUR FOREIGN EXCHANGES.

### The Mees Gasoline Carriage.

The Automotor Journal publishes an extended description of the vehicles built by M. Gustav Mees, and we are indebted to them for the following condensed description and illustrations. These carriages, we may remark, received a gold medal at the recent Berlin Exhibition for excellence in design and construction. The general appearance of the carriage is shown in Fig. 1, the carriage top being detachable. Fig. 2 shows the appearance with the body removed. The motor is vertically over the rear axle, and the variable speed drum, with its bevel gears and the sprocket wheels at the ends of the shaft, is visible about midway between the two axles. The motor is of the balanced type, which the demands of carriage work are now pushing into prominence. As may be seen from Fig. 3, it has two pistons working in opposite directions in a cylinder opened at both ends. Short links connect the pistons with the upper ends of rocking levers, and these levers are connected through the rods shown to the diametrically opposite crank pins on the shaft below the center of the cylinder. The working parts move therefore in opposite directions from the same centers at equal speeds, and the mechanical vibration is therefore in perfect balance. Fig. 4 is an external view of the motor, from which it will be seen that the working parts are wholly inclosed.

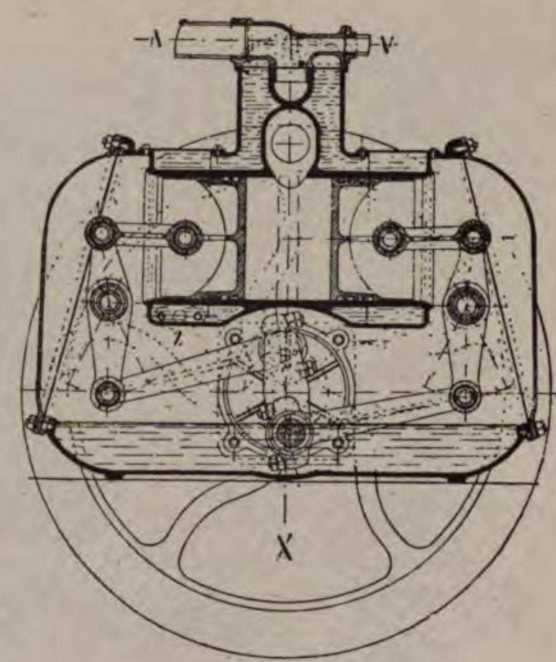


FIG. 3. SECTION OF MEES MOTOR.

FIG. 2. PERSPECTIVE VIEW OF FRAMING, &C.

Figs. 5 and 6 show in outline the elevation and plan of the running gear. As will be seen, the motor shaft lies in the direction of the vehicle's motion, and it carries on its forward end a bevel pinion engaging two bevel gears on the variable speed drum. The motion is transmitted from the drum through a differential on the same axis to the two sprocket wheels shown on the outer ends of the secondary shaft; and chains connect these with sprocket wheels on the

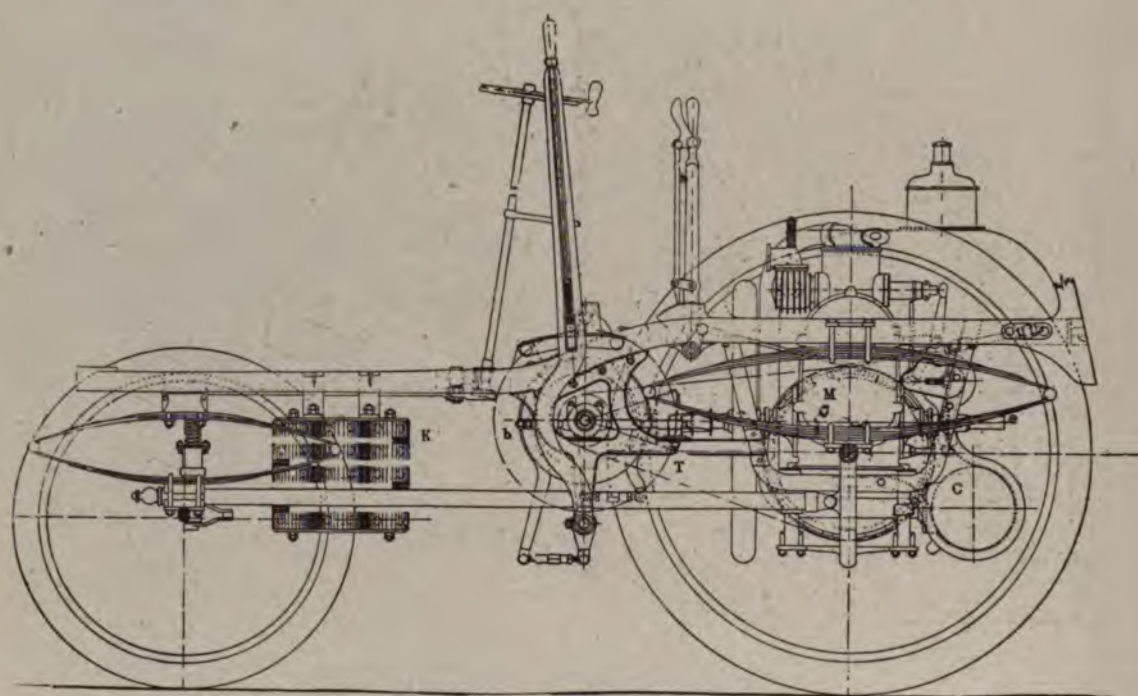



FIG. 5. SIDE ELEVATION OF FRAMING.

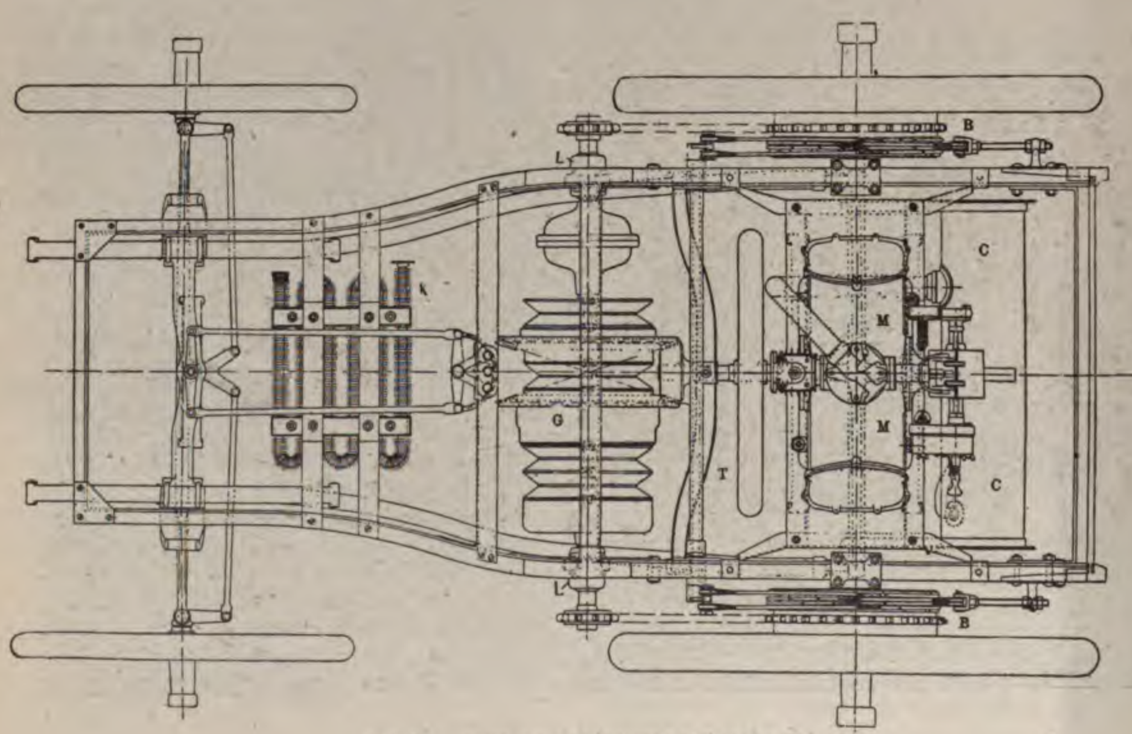



FIG. 6. PLAN OF FRAMING AND MECHANISM.

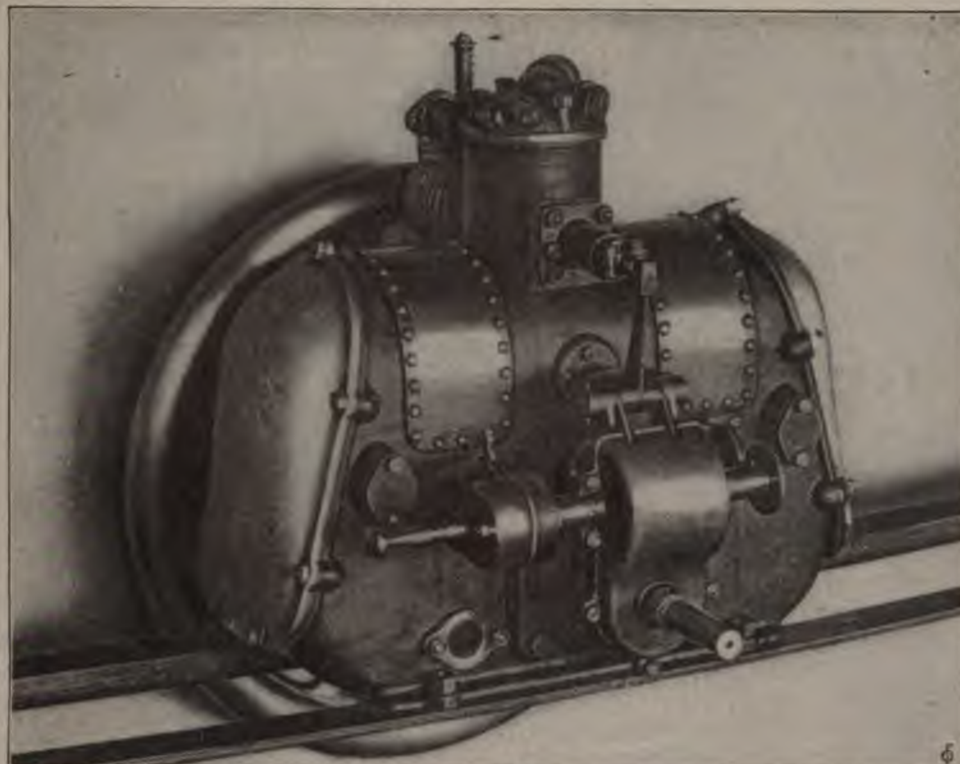


FIG. 4. THE MEES MOTOR.

rear wheel hubs. The rear axle therefore does not revolve; and it is bent downwardly between the wheels in the shape of a broad and shallow U. On this U the motor is supported through the medium of a transverse elliptic spring, so that the tires are relieved of the direct shocks due to its weight.

The reaches are of steel tubing, articulated at their rear ends to permit relative motion of the front and rear axles. The frame of the body is of bent wood braced with steel gussets and ties, and it is supported on elliptic springs at front and rear. The secondary shaft carrying the variable speed drum revolves in bearings bolted to the carriage body frame; but the central location of the motor shaft permits relative motion between the motor and the secondary shaft, in a vertical plane, without cramping the bevel gears. Brake drums are mounted on the rear hubs adjacent to the sprocket wheels, and both brake bands are controlled by a single lever.

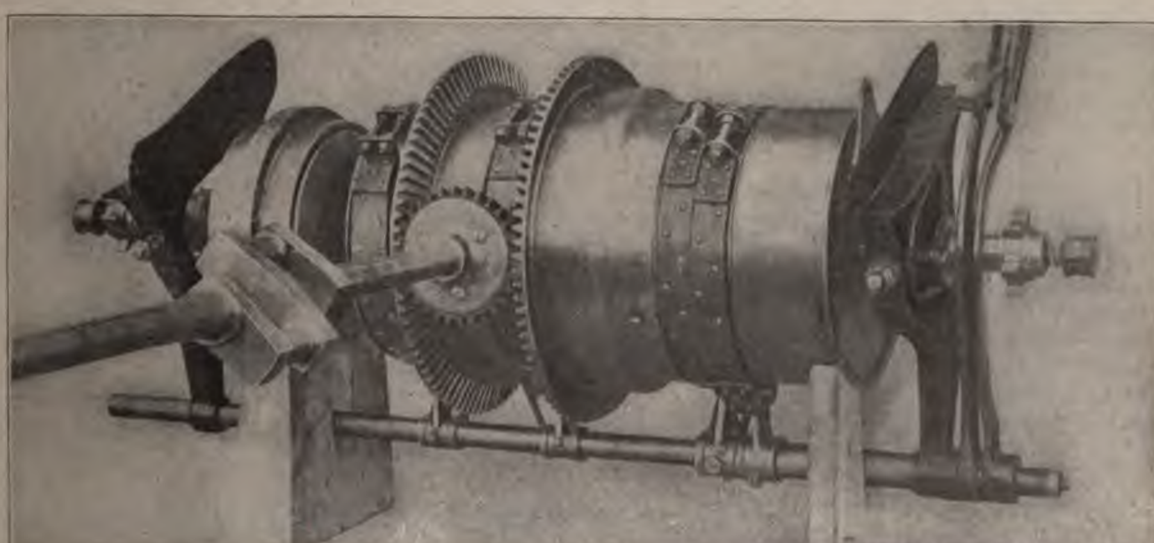


FIG. 7. EXTERNAL VIEW OF SPEED GEAR DRUM.

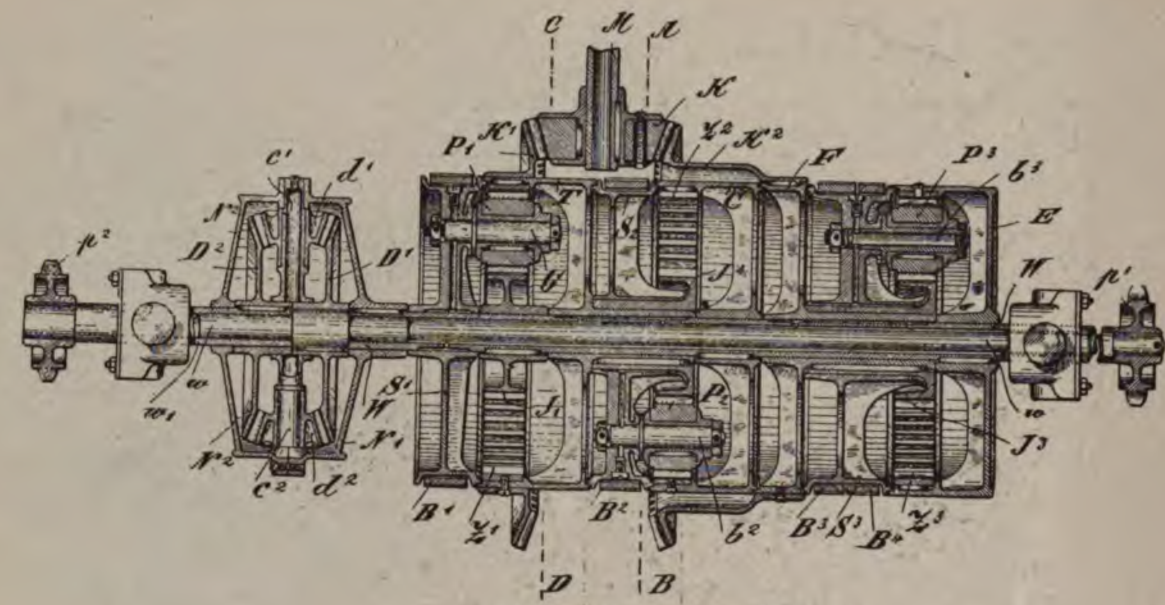


FIG. 8. SECTION OF SPEED GEAR DRUM.

The variable speed gear is the most interesting part of the mechanism and deserves a full description. An external view is shown in Fig. 7, with the motor shaft and bevel pinion occupying their normal position. Fig. 8 is a sectional view through the drum, gears and differential; and Fig. 9 is a side elevation on line C D looking to the left.

In principle the mechanism is a system of planetary gearing. For example, if in Fig. 9 the outer internal gear $Z^1$ be the driving member and the pinions $P^1$ turn on fixed studs, the inner spur gear $J^1$ will revolve at the same peripheral speed as $Z^1$. Owing, however, to its smaller diameter, it will make a correspondingly greater number of turns per minute than $Z^1$. Again, if $J^1$ be the driving member, then $Z^1$ will revolve at a slower rate than $J^1$. In both cases the driven member revolves in the direction opposite to that of the driving member.

In the Mees carriage the arrangement is such that either the outer internal gear or the inside spur gear may be made the driving member. Both will revolve in the same direction, and the motion of the driven member, whichever it may be, is communicated to a hollow shaft on which is keyed the differential drum. Reversal of motion is effected by a third series of these gears driving from the inner to the outer—i. e., at slow speed, and in the opposite direction.

In Fig. 8 M is the motor shaft and K the bevel pinion. Supposing the motor shaft to turn over from right to left, the bevel gear $K^1$ will run in a forward direction. This gear is keyed to the shell T, which carries the internal gear $Z^1$ and is likewise keyed at its hub to the small spur gear $J^2$, and revolves freely on the hollow shaft W; the pinions $P^1$ are mounted on studs $b^1$, which are carried by the brake drum $S^1$. In a similar manner, the pinions $P^2$ are carried by the brake drum $S^2$, and both these drums turn freely unless held by the brake bands on their circumferences. If now we suppose the first brake drum $S^1$ to be held, the motion of the bevel pinion K will be transmitted through the bevel gear $K^1$, the internal gear $Z^1$ and the pinions $P^1$ to the small spur gear $J^1$, which is

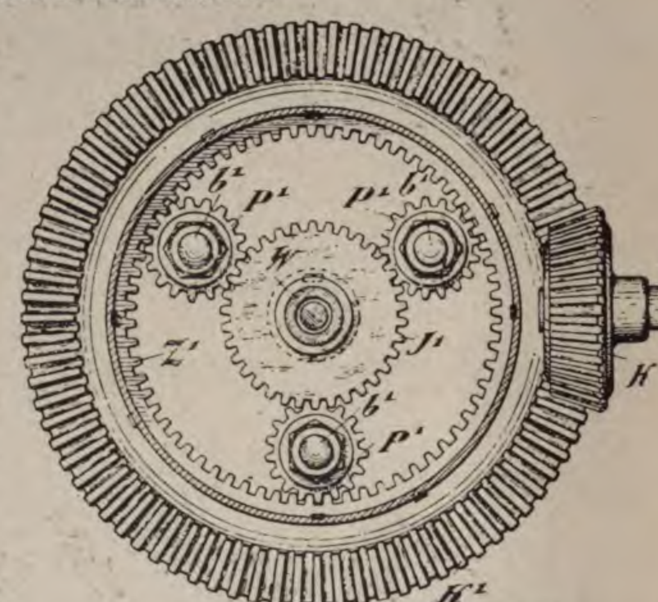


FIG. 9. SIDE ELEVATION ON LINE C D.

keyed on the shaft W. The motor is then in the high-speed gear, and the power is transmitted through the shaft W, the differential drum $N^1$ and the differential gears $D^1$ $D^2$ to the two portions of the split secondary shaft in the usual manner. If, on the other hand, the brake drum $S^1$ is released and the brake tightened on the drum $S^2$, the motion will be from the bevel gear $K^1$ through the shell T, the small gear $J^2$ and the pinions $P^2$ to the outer internal gear $Z^2$, which is keyed at its hub to the shaft W. The motor is then in the slow gear and the brake drum $S^1$ revolves idly at whatever speed may be given to it.

Both these forward speeds, it will be observed, are derived from the bevel gear $K^1$. If now we wish to reverse the carriage we release the brake band $B^1$ or $B^2$ and tighten $B^3$ or $B^4$;

and the motion is then transmitted from the pinion K, through the bevel gear $K^2$, the shell F and its hub, the small gear $J^2$, which is keyed to the latter, and the bevel pinions $P^2$, to the internal gear $Z^2$ and its hub.

As above noted, there are brakes on the rear wheel hubs; but it is possible likewise to check the carriage by an application of the reversing brake $B^3$ or $B^4$. This, it will be understood, does not reverse the action of the motor, since the drum $S^3$ will slip under the brakes until the carriage is brought to rest. Advantage is taken of this in arranging the controlling levers, so that a single movement will release the brake band $B^1$ or $B^2$ and apply $B^3$ or $B^4$. This is done by connecting the lever controlling $B^1$ and $B^2$ to the lever controlling $B^3$ and $B^4$ in such a manner that the application of the latter automatically releases the former brakes. In Fig. 7 the outer lever controls $B^1$ and $B^2$. When it is in its forward position the motor is in the high speed; when it is pulled back the motor is in the slow speed. The inner lever applies $B^3$ or $B^4$, both of which act alike, according to whether it is in its forward or back position. The two levers are connected by a latch on a segment in such a way that the outer lever controlling the speed can be moved independently of the inner one, which of course stands normally in mid-position when the carriage is running forward; but when it is desired to reverse the carriage the inner lever is thrown forward or back, according to which position the outer lever occupies, and this movement by means of the latch carries the outer lever along with it to the latter's mid-position. Both the speed drums $S^1$ and $S^2$ are then free to revolve idly, while the reverse drum $S^3$ is gripped and held.

The carbureter operates by surface evaporation and is placed at one side in the box back of the seat. An auxiliary water tank is on the other side in the same box. We give below a table of the dimensions, weight and speed of the motors and of the complete vehicles.

| B. H. P. of Motor. | Dia of Cyl. in Inches. | Stroke in Inches. | Revs. per Minute. | Weight Without Fly-wheel. | Weight of Fly-wheel. | Weight of Complete Vehicle. |
|---|---|---|---|---|---|---|
| 2 to 3 | 4.68 | 4.68 | 660 | 143 lbs. | 66 lbs. | |
| 4 to 5 | 5.46 | 5.46 | 630 | 220 lbs. | 88 lbs. | 1,430 |
| 6 to 7 | 6.24 | 6.24 | 600 | 264 lbs. | 110 lbs. | 2,300 to 2,500 |
| 8 to 9 | 7.02 | 7.02 | 550 | 319 lbs. | 143 lbs. | |

## Safety of Acetylene Gas.

The General Acetylene Co., 56 University Place, New York, makers of the "Bournonville" acetylene generator, have communicated to us the following incident, which goes to show that acetylene gas, when properly made and used, is as safe as any other form of illuminant. They say:

> From some cause a fire started on Sunday night, April 8, in a bottling establishment located on St. Paul's Ave., near Oakland Ave., Jersey City. The fire soon spread to the adjoining carpentry shop of Saul & Terhune, where a "Bournonville" generator was located. The place was totally destroyed, the gas machine being half buried amid the burning and smoking embers. The heat had been so great that part of the carbide holder had melted away, but otherwise the apparatus was uninjured, and all the gas remained in the gas holder intact.

## Some Interesting Things in Gears.

The Arthur Co., 188 and 190 Front St., New York, are firm believers in spiral gearing for speed reduction, and their shop contains many things of interest to those interested in this subject.

The editor of The Horseless Age spent a short time there recently and was shown a number of things out of the usual line, among which one of the most noticeable was a mechanism for a clock, which was made entirely by the Arthur Co. The clock is run by weights and stands about 8 ft. high. It has three dials facing three different ways, and each 25 in. in diameter.

There are numerous specimens of accurately cut nests of gears in the company's office, and a model illustrating the transition from worm to spiral gearing by means of six pairs of gears, having the ratios 1:1, 1:2, 1:4, 1:8, 1:16 and 1:32, with the driving members all on one shaft. The gears in this model have their axes at right angles to each other, but any other angle is possible.

It is beginning to be recognized that worm gears are inefficient only when the ratio of speed reduction is considerable, and the objections to them on this score do not apply to spiral gears with a ratio, roughly speaking, of 1:10 or less. The Arthur Co. have been well aware of this, and they are not afraid to take their own medicine. They have a number of gear cutting machines of their own design in which spiral gears transmit the power and reduce the speed from the belt to the cutter. A particularly interesting feature of some of these is the use of an elongated driving worm with the worm wheel made to travel along it by a separate feed. In this machine a pair of cone pulleys provides for the speed changes, the second pulley being on the shaft of the worm just mentioned. The worm wheel is on traversing cutter head and a pair of changeable spur gears transmits its motion to the cutter spindle. The cutter head is fed along by spiral gear transmission from a pair of cone pulleys driven from the main pulley. Ball bearing thrust collars are used on the cutter spindle and feed screw; and the machine is altogether a most original and effective one.

Another machine is for cutting worms by milling cutters inclined at the angle of the worm threads, instead of by a formed tool in a lathe, as is customary. This machine is the invention of Mr. J. F. Arthur, of the company.

The Paris Exposition authorities have appropriated 100,000 francs toward the expenses of the automobile section. This will be some 30,000 francs short of the estimated deficit. The Automobile Club of France has agreed to carry out the programme in practically its original form.

Over 100 automobiles are looked after every week at the Station No. 1 of the Automobile Storage Repair Co., 57 West Sixty-sixth St. They have space for stabling automobiles for the day or for any longer or shorter period, and skilled mechanics are always in attendance to look after repairs and to see that the carriages are in order. Electric current is supplied for charging purposes from the company's own plant, and gasoline, oil and supplies are always on hand. It is demonstrated that the station fills a real need, and the company contemplates establishing others in various parts of the city.

## Ball Bearing Co.'s Catalogue.

The catalogue of the Ball Bearing Co., Boston, Mass., contains several things of interest to those in the motor vehicle industry. Among these are roller bearings for rear wheels, designed for use on fixed axles, with the rollers running between two hardened shells. Thrust bearings are provided at the ends, and each wheel turns independently. The thrust bearings for heavy vehicles are of the usual form with rubbing surfaces, but for light vehicles a special form of ball thrust bearing is used instead. Both of these styles are clearly exhibited in section. In addition to these a design of front stub axle is shown with roller bearings and ball thrust. The Ball Bearing Co. supplies also the stub ends for the fixed portion of the front axle to fit the swiveling axle. All of the above are made in numerous sizes, and the appropriate load per axle is particularly specified for each size.

Other features of interest are the roller bearings for general use, and ball thrust bearings with grooved instead of flat collars. All the roller bearings made by this company embody the principle of short rollers used several in a series instead of one long roller in their stead; and this construction adapts itself much more readily to the slight but unavoidable irregularities of the sleeves. In the long bearings of this shape the ends of the rollers are staggered; and the same principle is used wherever possible in the ball thrust bearings to avoid wearing grooves in the collars.

## MINOR MENTION.

Automobiles to the value of $50,000 have been shipped recently from Chicago to Hawaii.

H. F. Borbein & Co., St. Louis, Mo., have moved into larger quarters at 1113 Cass Ave.

The Woods Motor Vehicle Co., of Chicago, have issued a catalogue of their vehicles.

The Cudahy Packing Co., Milwaukee, is to make trial of a gasoline truck in delivering its goods about the city.

The E. R. Thomas Motor Co. has leased a plant at Buffalo, N. Y., and will manufacture motor vehicles of all kinds.

The Hasbrouck Motor Co. will remove shortly from Newark, N. J., to Piermont, N. Y.

The Seguine-Axford Veneer Co., of Jersey City, has begun making moisture-proof wagon panels for motor carriages.

La Locomotion Automobile of April 5 contains an extended description of the Winton racing carriage, with illustrations.

John J. Kennedy, owner of La Parra Ranch, in Texas, is reported to meditate mounting his 50 cowboys on automobiles.

A Painesville, O., enthusiast is building a steam carriage out of the scrap pile. He says that it will cost when completed not more than $75.

The New Jersey Automobile Livery Co., capital $100,000, and the International Automobile & Vehicle Tire Co., Jersey City, capital $3,000,000, have been incorporated.

The Sparks Automobile Co., which was incorporated in San Francisco last October, is negotiating for a factory site and is considering San Jose.

The Standard Automobile Co. has been organized in Louisville, Ky., to build gasoline vehicles. Its capital is $1,000,000, and it will build a factory costing $100,000.

The big hill near the Rhinecliff Station of the N. Y. C. & H. R. R.R. is to be taken down to afford short transit for Col. J. J. Astor's automobile route between Rhinecliff and Rhinebeck.

The Jacks Autobain Co., of Napa, Cal., has purchased a runabout equipped with a 4 h.p. motor, which is mounted on a separate frame hinged to the rear axles and suspended by springs.

The Chinese Minister, Wu Ting Fang, is reported to have ordered an automobile, which will be built according to his own ideas. It will be of the phaeton shape and will be painted and upholstered in bright yellow.

A leaflet from A. M. Eames & Co., South Framingham, Mass., illustrates their several styles of rubber tired wheels for automobiles. These include both the Sarven or metal hub wheels for heavy work and the wood hub wheels for lighter work.

The Berlin Iron Bridge Co., of East Berlin, Conn., will remove their New York office on May 1 to the St. Paul Building, No. 220 Broadway. The office will continue to be in charge of Mr. Seymour N. Robinson, their New York representative.

The first vehicle of the St. Louis Electric Automobile Co. has been put on the road. It is of the Stanhope type, and we are promised full particulars for a later issue. The officers of the company are J. A. Graham, president; T. E. Bush, secretary, and A. L. Dyke, superintendent.

A cushion well suited to motor carriages has been brought out by F. H. Thompson, 36 Elm St. Portland, Me. The springs, of the bedspring or hourglass form, have their ends woven into wire cloth, so that the weight of a passenger is distributed over several springs.

An association of automobilists has been formed in Great Britain which is known as the Motor Vehicle Users' Defense Association. It is intended for the mutual protection of its members. Should an action be brought against a member relative to his automobile he is permitted to call on the association to take up his defense.

The Motor Cycle Co. has been chartered at Norfolk, Va.; capital, $750,000 to $15,000,000. The officers are: Ansel L. White, of New York, president; Frederick Stewart, of New York, treasurer; Benjamin J. Downer, of Montclair, N. J., secretary. These, with Ernest Hopkinson, of East Orange, N. J., and Joseph King, of New York, compose the board of directors.

**LOOK FOR THE**

**ACETYLENE MOTOR NUMBER.**

The Woods Motor Vehicle Co., of Chicago, is building eight large electric omnibuses for use in New Haven, Conn. The vehicles will be considerably larger than the ordinary 'buses drawn by horses. An endeavor will be made to supplant the surface railways in the central portions of the city. If the experiment proves successful in New Haven, Mr. C. E. Woods, manager of the Woods Co., says that an electric omnibus system will be established in Chicago.

It is announced that E. C. Stearns has severed all connection with the American Bicycle Co.; and that H. J. Lawson has arranged with the American Bicycle Co. for the manufacture of his "Gyroscope" motocycles at the Western Wheel Works in Chicago. This is Mr. Lawson's personal order, and the American Bicycle Co. has no connection with the Anglo-American Co. and no business connection with Mr. Lawson other than the above.

The New York & Ohio Co., of Warren, O., who have been working for the past year developing and perfecting a gasoline motor vehicle, have now commenced regular deliveries. They start out with a capacity of two carriages per week, which capacity will be very rapidly increased. We are promised photographs and a complete technical description of this machine, which the company state is in no way experimental, in the near future. Numerous patents covering all details have been applied for, and some have been allowed. The inventors are Messrs. Packard and Hatcher.

The works of Gould & Eberhardt, Newark, N. J., have been remodeled. The old walls at the front and sides of the main building have been torn down and new walls with large windows have been built; the style of architecture following closely that used in mill construction. Inside, the changes are not so marked, but another story has been added; advantage was taken of the opportunity to strengthen all the floors; electric lighting has been introduced and to some extent electric driving. The rooms of the building are lower studded than would be the case in a newer building, and the arrangement of the incandescent lamps is well adapted to these conditions, where head room is at a premium. Tin reflectors are used in the shape of an inverted trough, perhaps 30 in. long by 12 in. wide, and attached to the ceiling between the floor beams at suitable intervals. These reflectors are lined with strips of looking glass and contain three incandescent lamps each, which shed the light over a considerable area.

## METROPOLITAN NOTES.

Incredible as it may seem, there are still 8,000 street horse cars in New York City.

C. J. Dunning, of No. 10 Barclay St., has the New York City agency for the Baldwin Chain Co.

J. J. McCabe & Co., of 14 Dey St., New York, are getting out a price list of second-hand tools for automobile builders.

The new Excelsior Dry Battery Mfy., 193 Greenwich St., New York, has produced a dry battery which is claimed to be non-polarizing.

Twenty-six permits for open pleasure carriages with electric motors have been issued by the Park Board of this city and three more for electric broughams.

The Hancock Inspirator Co. is making the Loftus Restarting Injector in a small size for steam carriages. It has connections for a ⅛-in. pipe.

J. H. Williams & Co., 9 to 31 Richard St., Brooklyn, are entering the motor vehicle field and are prepared to take orders for drop forgings in any style or quantity.

The Barnes Carriage Co. has entered the motor carriage field and is taking orders for vehicle bodies. They have recently removed to 147-149 West Ninety-ninth St.

The New Jersey Zinc Co., New York, have put on the market a new paint which they call "Zinc White," which they claim greatly exceeds in durability the ordinary white lead.

C. N. Lockwood & Co. are preparing an illustrated catalogue of carriage lamps, among which they will show a number of special lamps for automobiles.

The Ducasble Tire Co., lately established in Philadelphia, have opened offices at 49 Broadway, New York City. They manufacture rubber tires for bicycles of all kinds.

The Manhattan Automobile Station, 213 W. 32d St., has given up business, and the electric carriages there stored have been transferred to the Automobile Storage and Repair Co.'s station, 57 W. 66th St.

The New Brunswick Rubber Co., 9 to 15 Murray St., New York, has been succeeded by the New Brunswick Tire Co. The latter company expects to enter the field with motor vehicle tires.

The Upton Machine Co., of Beverly, Mass., have removed their headquarters to 17 State St., New York City. Henry W. Goodrich is president, Colcord Upton vice-president and general manager, and Wm. J. Murray secretary and treasurer.

The James H. Lancaster Co., of 95 Liberty St., New York, has just brought out the first of its line of gasoline automobiles. The new vehicles embody a number of novel features in construction and design, and are to be known as "Lancamobiles."

The Nathan Mfg. Co. has brought out a cylinder lubricator for gas engines, which has feed adjustment separate from the shut-off cock, so that it can be turned on and off without altering the determined rate of feed. A ball check valve secures the interior against excess of pressure from the cylinder.

The Federal Battery Co., 11 Pine St., New York, are introducing a dry battery using their "Federal Salt," which they claim to be far superior to sal ammoniac. They claim for this battery a higher voltage, lower internal resistance and longer useful life than any other on the market. They recommend them particularly for gas engines.

The Rose Mfg. Co., of 910 Arch St., Philadelphia, have produced a special style of motor vehicle, which will be on exhibition at their New York office, 107 Chambers St., next month. This company has a new lamp they have named "The Neverout." It burns kerosene and has a patented insulated reservoir free from grease. A dashboard bracket makes it suitable for motor vehicles.

# MOTOR VEHICLE PATENTS

## of the world

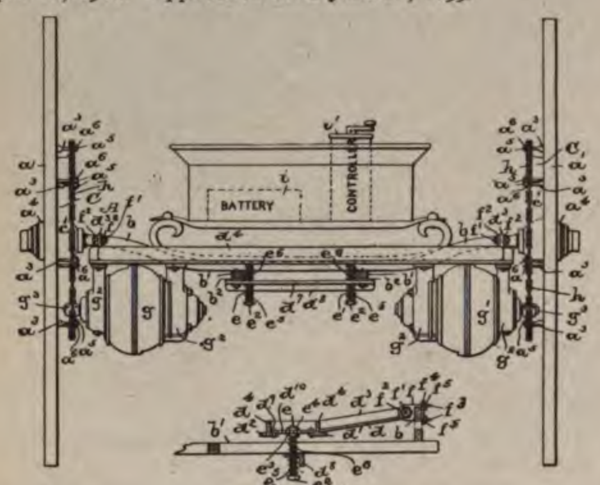
### UNITED STATES PATENTS.

No. 646,982—Motor Vehicle.—Rudolf Hagen, Cologne, Germany. April 10, 1900. Application filed Nov. 9, 1899.

A link and lever transmission from the motor to the rear axle.

Four claims.

No. 646,993—Motor Vehicle.—Frank K. Irving, Newark, N. J., assignor of one-half to Andrew G. Vogt, same place. April 10, 1900. Application filed June 22, 1899.




A spring suspension for an electric motor. The rear axle b is bent downwardly, as shown, and the reaches $b'$ $b^2$ bolted to it. The motor is attached to the frame d $d'$ $d^2$, etc., which is pivoted at $f'$ $f^2$ to the rear axle. Ties, $d^4$, and a plate, $d^7$, connect the reaches, and these carry the weight of the motor through the medium of springs, $e^6$. Other springs, $e^5$, are added to check the upward rebound of the motor frame.

No. 647,113—Antifriction Bearing for Vehicle Wheels.—Edward Phipps, Glenville, O. April 10, 1900. Application filed March 23, 1899.

A combination axle and thrust bearing.

No. 647,170—Tire Fastener for Vehicle Wheels.—Conrad Waechter, Jr., Mt. Vernon, N. Y. April 10, 1900. Application filed Feb. 19, 1900.

The object of this invention is to provide a fastener for solid rubber tires of such a nature that it can be secured in place without welding or brazing. The tires are held by steel wires running through them, as shown in Figs. 4 and 5. The ends of these wires are joined by a thimble shown in section in Fig. 6. This thimble is adapted to receive the ends of the wires, which are notched as shown; and the ends of the thimble are then locked in the notched ends of the wire by being bent or hammered down, as shown at 6 in Fig. 6.

Three claims.

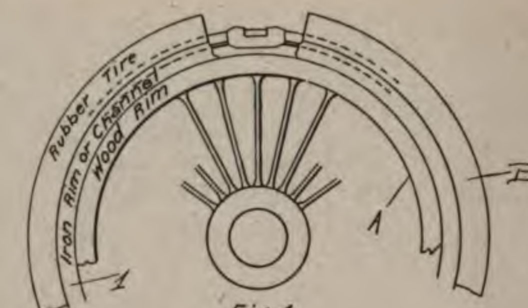



Fig-4

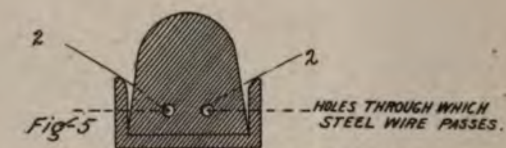



Fig-5

Cross section of Rubber Tire and Iron channel.

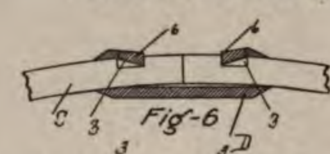
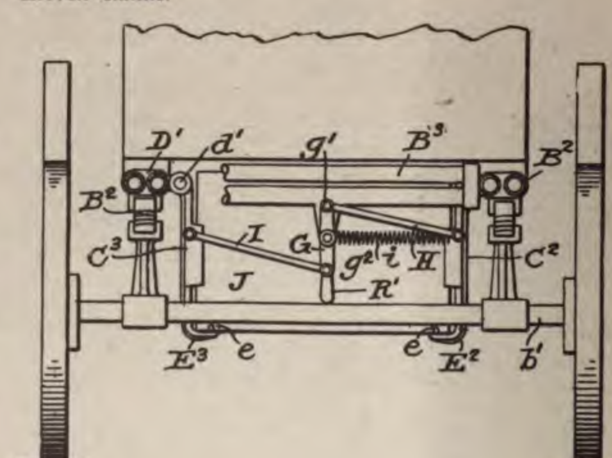


Fig-6

No. 647,251—Storage Battery Suspension for Motor Vehicles.—G. Herbert Condict, New York, N. Y., assignor to the Columbia & Electric Vehicle Co., of Jersey City and Hartford. April 10, 1900. Application filed July 30, 1898.

The figure shows the invention as applied to automobiles. J is the battery tray and $C^2$ $C^3$ the suspension arms, which are pivoted to the reaches D'. The handle R' is pivoted at G, and it spreads the arms $C^2$ $C^3$ by means of the links I H, whereby the battery tray is released and free to be moved downward and away from the vehicle. The spring i holds the arms $C^2$. $C^3$ normally in the position shown. It is assumed that the battery tray is slightly lifted by suitable means to relieve the suspension arms of its weight, before the latter are spread.

Eleven claims.



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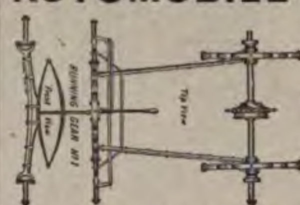

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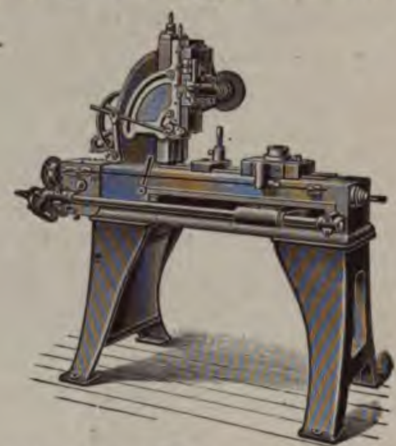

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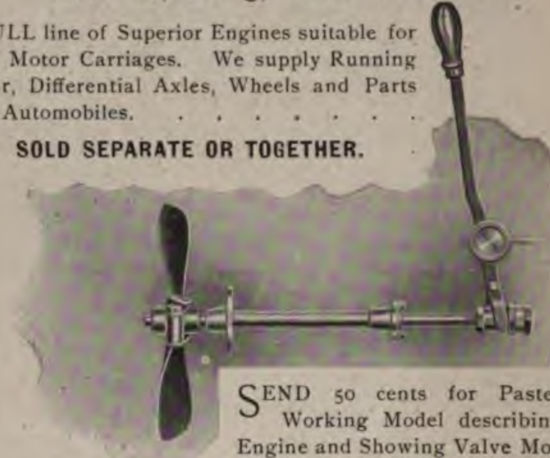

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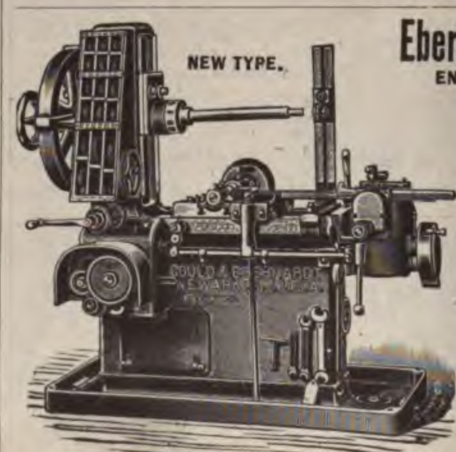


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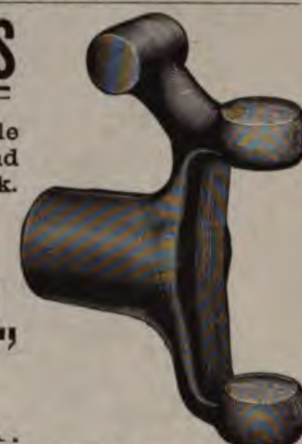

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# MOTOR WHEELS.

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# THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. VI. NEW YORK, MAY 2, 1900. No. 5.

THE HORSELESS AGE.

**E. P. INGERSOLL, Editor and Proprietor.**

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

**HERBERT LADD TOWLE, Associate Editor.**

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## Publishing Dimensions.

Our esteemed contemporary, the American Machinist, has lately published several things anent the business methods of gas engine builders; and in a recent issue a correspondent who signs himself "Theorastus" describes as follows his attempt to get information regarding cylinder dimensions before purchasing: "I went to the different shops and inspected their igniting, governing and other devices; also asked for the dimensions of the cylinders; for my idea of an economical engine is one with a small cylinder that will give the greatest power possible—that is, I would prefer an engine with a cylinder 5 in. diameter by 5 in. stroke to one having a cylinder 5¼ x 6½ in., if their power were both the same, which in this case was 2½ h.p., guaranteed.

"I entered a large shop that employed many men and made many engines, intending to examine their engine, as I had several engines of other makes. * * * Soon after I stepped in the shop engine refused to work, and all hands were idle for a while. This gave me a good opportunity to look around. Presently I entered the office of the salesman and asked him a few questions about the engines, but when it came to the dimensions of the cylinder I was told that the only way to find that out was to buy one and measure it. Mr. Editor, you know that in describing steam engines the dimensions of the cylinder is a point in consideration and always accompanies a description of the same; yet in gas engine catalogues such a thing is unknown, for I have never seen in one the diameter and stroke stated. Why is it? Do they fear comparisons?"

This communication elicited another from a New Haven company, which announced itself an exception to the rule, saying: "It is a fact on record that ever since we started to manufacture and sell stationary, marine and automobile gas engines, we have pursued the policy of inviting the closest inspection and investigation of our work, both in our shop and out of it, and have published in all of our catalogues and advertisements the cylinder areas and brake horse-powers in every possible way, and absolute and complete information in regard to our engines. We are always ready to furnish a prospective customer, or in fact any one interested, with the actual working blueprints as used in our shop, provided they are willing to pay a reasonable price for the same. * * *

"We believe if a concern intends to market gas engines or any other machine that it then becomes to a certain extent public property, and it is not only unbusinesslike but ridiculous to attempt at the same time to sell and market an article and yet endeavor to withhold and keep as a secret all the essential details of its construction."

We know of one or two other concerns building motors for stationary and marine work that publish cylinder dimensions in their catalogues; but of the great majority, if not all, of the rest it is certainly true that the only way to get this information about the engines is to "buy one and measure it." "We even refuse to give drawings with our bids," said the vice-president of one of the most successful gas engine firms in America, in a recent conversation with The Horseless Age. "We are constantly experimenting and seeking for improvements. We have our difficulties and we have our successes.

If we have difficulties we keep them to ourselves; if we have successes they belong to us. We guarantee the economy of the engine; that is all."

To this, as to most other questions, there are two sides. What the purchaser really cares about is the economy, not the cylinder dimensions. If he is told the latter, he must still test the engine to find if it reaches the brake horse-power claimed; and it is a very simple matter, while making the brake test, to measure the amount of gas or gasoline consumed. If then he knows the richness of the gas (if it is a gas engine) he has direct and unimpeachable proof of his engine's economy, which renders superfluous any particulars as to dimensions, while without information as to the quality of fuel he is using his cylinder figures tell him nothing, since a poor showing as to power may be due merely to poor gas. If the engine uses gasoline or kerosene, he has only to get a guarantee of economy for the particular grade used and employ that in the test.

If, on the other hand, the purchaser merely tests the power of his engine, he still needs several particulars besides the diameter and stroke before he can judge its economy. The number of active strokes made per minute comes first, of course, since this, in combination with the piston area, is a measure of what we may call the "stroke volume" per minute, or the number of cubic feet of mixture drawn in, burned and expelled. A small engine may give the same power as a larger one if it is run fast enough. But the density of that mixture as it enters the cylinder is considerably affected by the speed; a high-speed engine must have its air ports, vaporizer or mixer and valves proportioned to its speed, and if an engine is forced beyond its rating the stroke volume swept may be wholly misleading as to its actual fuel consumption. The regulation also will modify the economy; and for complete information the engine must be tested under both full and half load. Again, some engines are purposely built to throttle the mixture and take less than a cylinderful per stroke, while other builders endeavor to give their engines as full a charge as possible. All these items are taken account of in a fuel test, while not one of them is hinted at by the "area times stroke" method of comparison.

In the case of stationary and marine engines, therefore, or of any which run at constant speed and approximately constant load, the builder's refusal to give his cylinder dimensions to his customer may be regarded as a proper safeguard against amateur criticism. Any reputable builder will guarantee his engine's economy under given conditions; and as this is the most direct route to the desired end, his customer has no reason to complain. As a protection against competitors, such reticence amounts to very little, since any concern that set out deliberately to copy another's line would hardly consider the cost of one engine of each size, which it could resell after it had made drawings from it, an obstacle worth hesitating over.

When we come to vehicle motors, however, the case is wholly different. The uselessness of concealment from competition is even greater, since the range of sizes is so small and the cost of buying samples so trifling. Only the veriest of cross-roads repair shops could refuse that outlay; and the cross-roads repair shop would not be a competitor to be feared. The vehicle motor more than any other is the product of specialized craftsmanship, wherein the information to be gained by dissecting it is but the bare groundwork to build on. But aside from that, there is really no such thing as a "rated horse-power" for the vehicle motor, unless that motor is to run at constant speed. In this country the disposition is to minimize the speed changes by gearing and to vary the motor's speed where possible. Consequently the motor must be capable of being slowed down to a walk, so to say, and likewise of being pushed on occasion to a speed of perhaps double what could reasonably be expected of it in steady service. It must be designed to stand anything; and if it is to be rated according to its power the only logical course would be to label it with the utmost it could be made to do.

Obviously, however, no such procedure would be tolerated by the motor's purchaser, who would expect it to be rated at what it would do in steady service and with no more than reasonable wear. This, however, is entirely too unstable a quantity to withstand the shocks of competition; and we are therefore reduced to the conclusion that the only way to rate the power of the motor as such, and apart from what th carriage will do, is to give its cylinder dimensions.

This is a long way from indicating what the power wi be—even longer than with stationary engines, as experienc is repeatedly proving. Nothing is more striking in the anna of present-day racing than the great influence of differer forms of vaporizers, carbureters or igniters on the speed the motors to which they are applied. But it is better tha the vague and elastic claims as to horse-power now so con mon; and already it is the rule in France and to some exte in England for the cylinder dimensions to be given in tl published description of a new motor, as an essential pa thereof. We believe that eventually motor carriages will rated in some such way as is proposed in the article on "Mot Carriage Trials," by E. C. Oliver, in our issue of April 1 but until this is done it would seem a better plan to gi dimensions than "rated" powers.

## Light on a Dark Subject.

Small gas engine design is too often abandoned to pure empiricism; and guess work, experiment and cut-and-try methods might almost be said to be characteristic of that branch of the industry in this country. When, however, we consider that it deals with agents so subtle and elusive, and yet withal so vital, as it does, this appears somewhat less strange. The steam engine itself is not too easy a problem, even for the best engineers; and even at this date certain of the fundamental propositions regarding it are still in debate, among which the most noticeable is the real thermo-dynamic value of the compression. But if it is difficult to design a steam engine of the highest possible efficiency for the conditions under which it works, it is even more difficult to do this for the gas engine. The proportions of the mixture, its temperature and its density, and the speed of propagation of the flame, continually evade control as the conditions change, and for the beginner it is difficult not merely to produce an efficient engine, but to get one that will run with anything like regularity and reliability.

Style 1, Fig. 1: Length of tube, 2 m. = 78¾ in.
Number of ribs, 250.

Style 2, Fig. 2: Length of tube, 1.7 m. = 67 in.
Number of ribs, 204.

These radiators weigh about 2½ lbs. per yard.

We have now for the first case above, with radiator in front:

Style 1: Surface of tube, 83 sq. in. nearly.
Surface of ribs, 745 sq. in.
Total surface, 83 + 745 = 828 sq. in.

Style 2: Surface of tube, 105 sq. in.
Surface of ribs, 893 sq. in.
Total surface, 105 + 893 = 998 sq. in.

For the second case, with radiator below or behind:

Style 1: Surface of tube, 139 sq. in.
Surface of ribs, 1,240 sq. in.
Total surface, 139 + 1240 = 1,379 sq. in.

Style 2: Surface of tube, 118 sq. in.
Surface of ribs, 1,012 sq. in.
Total surface, 118 + 1012 = 1130 sq. in.

We may practically consider the mean of the above values for each case as giving the necessary surface. Thus, for the first case, the necessary surface will be

$$\frac{828 + 988}{2} = 913 \text{ sq. in. per h. p.}$$

and for the second case it will be

$$\frac{1379 + 1130}{2} = 1255 \text{ sq. in. per h. p.}$$

Under the respective conditions of their use, therefore, each of the above surfaces (913 and 1255 sq. in.) will radiate 2041 B. T. U. per hour at a temperature of, say, 203 degs. F.

Let us now compute this required radiating surface by the ordinary formulæ for the heat lost by radiation and convection, considering for this purpose the second case first, of the radiator below or behind the carriage. In this case the effect is about equivalent to that with the radiator in front and the carriage standing still. The formulæ are as follows, and may be found in treatises on physics:

Put Q = the heat dispersed by radiation per square inch of surface per hour, measured in B. T. U.

Put $Q_1$ = the heat dispersed by convection (i. e., which warms the air by actual contact of the latter with the metal) measured as before.

Put T = the temperature of the air, in degrees Fahrenheit.

Put t = the difference in temperature between the radiating surface and the air in degrees Fahrenheit.

Put k = a coefficient depending on the character of the surface.

Put $k_1$ = a coefficient depending on the form of the surface.

Then

$$Q = 0.318\ k \times 1.0077^{\frac{5(T-32)}{9}} \times (1.0077^{\frac{5t}{9}} - 1).$$

$$Q_1 = 0.00141\ k^1 \times \left[\frac{5t}{9}\right]^{1.233}$$

It will be noticed that the exponents $\frac{5(T-32)}{9}$ and $\frac{5t}{9}$ are equal respectively to the values of T and t in degrees Centigrade.

The coefficient k has the following values for the commoner metals:

| | |
|---|---|
| Polished copper | 0.16 |
| Rough sheet iron | 3.20 |
| Rough cast iron | 3.17 |
| Old cast iron | 3.36 |
| Black enamel | 3.71 |

The coefficient $k_1$, for a spherical contour, has the value

$$k_1 = 1.778 + \frac{0.14}{r}$$

where r is the radius of the body in yards. For a horizontal cylindrical body of radius r yards

$$k_1 = 2.0.58 + \frac{0.0424}{r}$$

For a flat surface $k_1$ = 2058 and this is the value which we will assume for the radiators, since the ribs constitute the larger part of the latter's surface. For k we will take 320 as an average value. For T we will assume 59 degs. as a mean value: this gives for t 203 — 59 = 144.

Substituting these values in the formulæ, and reducing by the aid of logarithms, we find

Q = 0.971 B. T. U. per sq. in. per hour,
$Q_1$ = 0.644 B. T. U. per sq. in. per hour,

giving a total of 0.971 + 0.644 = 1.615 B. T. U. dispersed per square inch per hour.

As seen above, we must dispose of 2041 B. T. U. per hour per horse-power; and this requires a surface of $S = \frac{2041}{1615} =$ 1263 sq. in. per horse-power. As we derived an average value of 1255 sq. in. for this condition from the two practical cases above, we see that our present result is sufficiently close.

Let us next consider the case of a jacketless motor with radiating ribs. For this purpose we will take the following data from an actual case. The cylinder and head were of the form shown in Fig. 3. The piston was 2⅝ in. diameter, the stroke was 3¾ in., and the R. P. M. under load 1200. At this speed the motor gave 2 b.h.p.

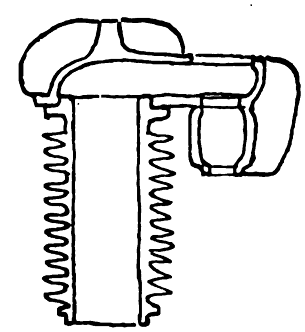


Fig. 3.

The cylinder wall was cooled by 17 ribs of 21 mm. mean depth and a surface of 23.56 sq. in. each, or 400 sq. in. for the 17. The mean temperature of the ribs was about 310 degs. Supposing this in the above formulæ, and using same values as before for k, $k_1$, and T, we find for the 400 sq. in. a value of 860 for Q and 486 for $Q_1$, or 1346 B. T. U. total.

The cylinder head of the motor had 16 ribs aggregating 82 sq. in. in surface, and other surfaces to the extent of 16 sq. in., or a total of 98. The mean temperature here was 490 degs., from which we obtain values of 595 and 237 for 98 sq. in. for Q and $Q_1$, respectively, or a total of 832 B. T. U.

The exhaust valve case had 11 ribs aggregating 56 sq. in., and other surfaces of 7 sq. in., or a total of 63 sq. in. The mean temperature here was 662 degs., giving $Q = 859$ and $Q_1 = 214$, or a total of 1073 B. T. U. for the 63 sq. in.

Adding these totals, we find the total heat dispersed to be

$$1346 + 832 + 1{,}073 = 3251 \text{ B. T. U. per hour;}$$

and as the motor was of 2 h.p., we have 1,625 B. T. U. per horse-power per hour as the heat which the motor will radiate when the vehicle is at rest.

If now we consider the influence of the vehicle's speed on the above radiation (assuming the motor to be in front), it is evident that only the convection will be affected thereby. We have seen above, in the case of the water radiator, that the effect of the vehicle's motion was to increase the total heat dispersed in the proportion of 1255 to 913. As we have calculated that the motor will radiate 1.615 B. T. U. per square inch per hour when the carriage is stationary, it will radiate when the carriage is running

$$1.615 \times \frac{1255}{913} = 2.221 \text{ B. T. U.}$$

and the increase is $2.221 - 1.615 = 0.606$ B. T. U. As just mentioned, this increase is wholly from the added heat loss by convection; and as the original value for the convection was 0.644 B. T. U. per square inch per hour, the increase is in the ratio of $\frac{0.606}{0.644}$. Taking now the sum of the convection-losses $Q_1$ in the actual motor—we find it to be $486 + 237 + 214 = 937$ B. T. U. per hour. Multiplying this by the above ratio to find the increase, we have

$$937 \times \frac{0.606}{0.644} = 880 \text{ B.T.U.}$$

This is the increased convection-loss for 2 h.p.; for 1 h.p. it will be 440 B. T. U. per hour.

We have finally, therefore, a heat loss of 1625 B. T. U. per horse-power per hour with the carriage stationary, and $1625 + 440 = 2065$ B. T. U. with the carriage at speed. As we found above a heat loss of 2,041 B. T. U. per horse-power per hour from the water radiators, we may infer (what was in fact the case) that when the carriage is in motion the cooling ribs are quite sufficient for the motor in question. We note also that the increase of cooling effect when the carriage is running amounts to about 25 per cent.

This motor had a compression of 60 lbs. In larger powers it would probably be necessary to reduce either the speed or the compression, or both, to avoid overheating; but the writer believes that as high as 4 h.p. might be reached without cooling water, using a speed of, say, 900 revolutions, and a moderate compression.

## The Pivot Steering Gear in Practice.

By P. M. Heldt.

The pivot steering gear, or Akermann steering gear, as it is often called in England, is at present quite generally used on automobile vehicles, the only notable case of which the writer knows in which it is not used being that of the electric cabs circulating in Paris.

The pivot steering gear has the advantage over other forms of steering gears that when its parts are properly dimensioned the axes of the various wheels always meet in one point, for any position of the steering wheels, and there is therefore no dragging of any of the wheels when turning corners. Another advantage, and the most important, lies in the fact that the force due to the running of the wheels against obstacles in the road is transmitted to the steering lever through a much shorter lever arm in the case of pivot steering than if a swiveling forecarriage is used. The length of the lever arm here in question is the distance between the center plane of the wheel and the prolongation of the center line of the bolt or stud on which the steering spindle turns, at the distance from the ground at which the obstruction strikes the wheel. With steering spindles as originally made, this lever arm can easily be made short enough, so that the steering of a light carriage over good roads does not produce any unusual fatigue; but for vehicles of heavier weight and for high speed and bad roads it has been found that the irreversibility of the ordinary pivot steering gear is insufficient, and that either an irreversible transmission member has to be interposed between steering spindle and steering lever, or else the length of the lever arm, alluded to above, has to be reduced more than is possible to reduce it while retaining the original form of steering spindle.

A number of manufacturers have sought to solve the problem in the former manner, while others have changed the construction of the steering spindle. We will follow the latter in the present article.

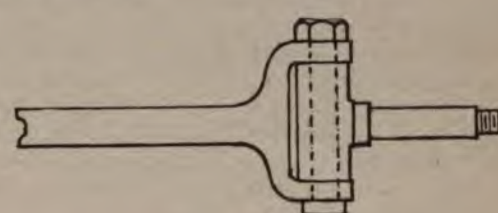


FIG. 1.

The pivot steering axle in its simplest form is shown in Fig. 1. The axle is forked at the ends to receive the steering spindle. A bolt passes through the head of the steering spindle and both arms of the fork, and around this bolt the spindle swivels.

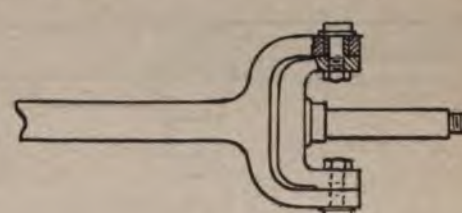


FIG. 2.

In Fig. 2 is shown an improved steering spindle, designed to reduce the distance between the center of plane of the wheel and the center of the swivel pin. The head of the steering spindle is arched, and the connection between axle and steering spindle is made by two shoulder screws. These shoulder screws pass through hardened steel bushings in the fork arms, and screw into the head of the steering spindle. They are provided with lock nuts. The inner flange of the hub just clears the shaft and the distance from the center of the screws to the center of the wheels is from 2 to 2½ in.

While there is a gain in this direction, there is certainly a loss in another one, as the forging and finishing of the steering spindle, Fig. 2, requires considerably more work than does the forging and finishing of the spindle shown in Fig. 1.

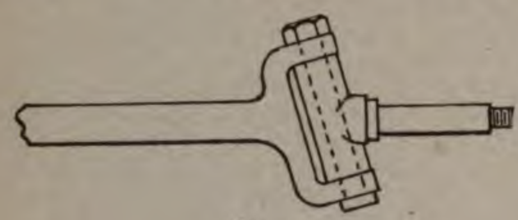


FIG. 3.

In the steering axle shown in Fig. 3, the line running through the center of the steering pivot is slanting, and intersects the line running vertically through the center of the wheel at the point where the latter strikes the ground, or a little above this point. As it is large obstacles especially that ought to be guarded against, it is well to place the point of intersection about 2 in. above the ground. This form of steering gear is perfectly irreversible. In turning the wheels out of the straight forward position, they assume a slanting position, and there is therefore a somewhat greater strain on the spokes than if the wheels turned around a vertical center line.

In Fig. 4 is shown a steering spindle, with hub, in which the center of rotation of the spindle is inside the hub, coinciding with the center of the wheel. The two views shown fully explain the construction. The hubs have to be rather large in diameter, and ball bearings are best adapted to this steering spindle. These wheels always retain a vertical position, and the steering gear is absolutely irreversible. The steering spindle here illustrated is that of the Haynes-Apperson Co. Similar steering axles are made by the Riker Co. and by Clubbey and Southey in England.

Steering spindles are now often pivoted on ball seats, which reduces the force required to turn them.

In Figs. 2 to 4 are illustrated the modifications of form given to the pivot steering gear to render it irreversible. A number of other modifications, to be described, have the object of reducing the cost of construction. Examples of such modifications are shown in Figs. 5 and 6.

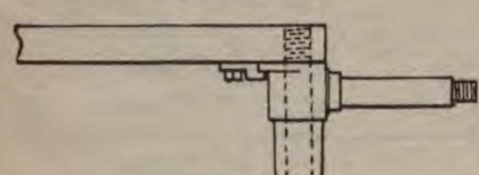


FIG. 5.

The axle, Fig. 5, is upset and rounded at the end, and is drilled and tapped to receive a stud thread at one end. The head of the steering spindle is bored and fits over this stud. The head is provided with a flange at the upper end which passes under a forged lip, fastened to the axle, thus preventing the spindle from slipping on the stud when the vehicle passes over rough roads.

The axle shown in Fig. 6 is also upset and rounded at the ends, and has in addition a piece welded on either end at right angles to the center line of the axle. The construction is perfectly plain from the sketch. The spindle is prevented from slipping by the same means as employed in Fig. 5.

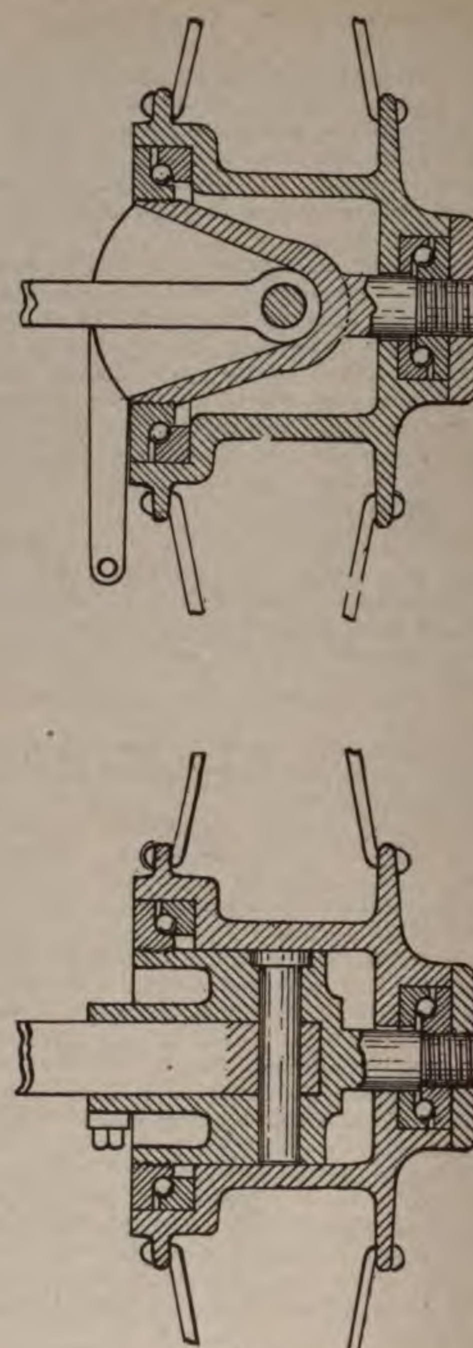


FIG. 4.

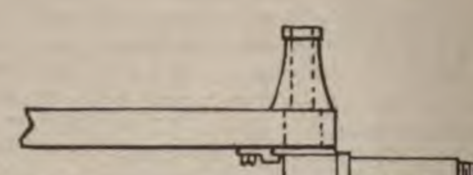


FIG. 6.

## A Mixing Valve for the Trade.

We illustrate herewith two forms of mixing valves which have been designed for use on gasoline engines. They take the place of carbureters, and, for certain purposes, users have found them more efficient and reliable in every way. The construction of these valves is very simple, and there is no liability of their proving troublesome after having been in use a short while. The manipulation is so simple that it can be understood by any one and it is not difficult to secure good results.


FIG. 1.—ANGLE PATTERN.

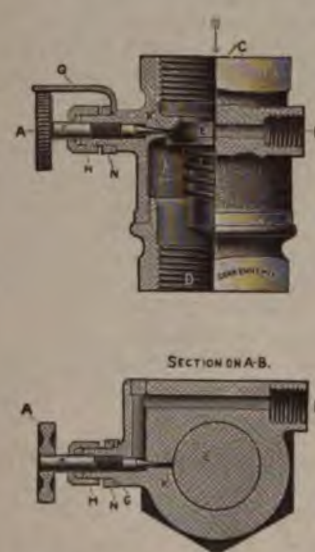



FIG. 2.—VERTICAL PATTERN.

Referring to the sectional views, it will be seen that the valve disk E is held against its seat by a light spring, M. The seat of this valve is wide and the port opening slightly smaller in diameter than the pipe connections. The body of the valve L below the valve disk is of full area. At the side of the valve body is a gasoline inlet, B, tapped for ¼-in. pipe thread. From the side gasoline inlet B a passageway of ample area leads around and through the valve body and is in communication with the main valve seat. The opening of this passageway K into the valve seat is controlled by a small needle valve, F, which has an indicator arm, G, in connection therewith, and the wheel handle A on the end of the valve stem can be engraved to show different degrees of opening. The valve stem F has a large size stuffing box, H, so as to enable it to be well packed to prevent leakage of gasoline.

The operation of the mixing valves is as follows: When the engine draws in the charge the vacuum allows the pressure of the atmosphere to act upon the disk E and open same; at the same time the gasoline inlet K is uncovered and the required amount of gasoline is injected, thus forming the charge. The passageway from the gasoline inlet B to the gasoline outlet K is so arranged that the end of the regulating valve in the latter is as close to the seat E as possible, and has very little clearance. The result of this is that gasoline is injected in the form of a spray, thus mingling thoroughly with the air admitted through the opening C. On the return stroke of the engine, as the charge is compressed, the internal pressure, assisted by spring, M, closes the main valve disk E very quickly, which, in turn, closes the opening of the gasoline inlet K, and further injection of gasoline is prevented. The small needle valve F that controls the flow of the gasoline to the gasoline inlet K has a long taper bearing, and the stem threads are of fine pitch; thus very close adjustment can be secured, and the amount of gasoline injected can be regulated to a nicety. As the wheel handle A can be engraved with notches to show the different degrees of opening, it requires very little instruction to enable an inexperienced operator to properly manipulate the valve. The port opening in the main valve disk E is always one size smaller than the pipe connection—that is, for instance, a 1¼-in. valve has 1-in. opening through the seat. The result of choking the port opening is to cause the valve to have greater lift when opening, due to the increased draft of air through same. These mixing valves are best used with a float-controlled tank or overflow cup, so that the level from which the gasoline is drawn is always a little below that of the opening B, thus preventing the gasoline from accumulating in the air pipe in case the valve disk E fails to seat tightly.

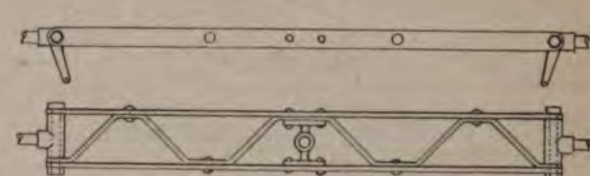
The Lunkenheimer Co., Cincinnati, are the makers of these valves.

## A Simple Steering Axle.

By P. M. Heldt.

The forging of the forks at the ends of steering axles is a piece of work which requires considerable skill and time. After being forged, these forks must, as a rule, be finished all around, which also takes considerable time. It is for this reason that steering axles of the usual construction are rather expensive.

The writer would therefore recommend for vehicles in which beauty of design is not a primal consideration the axle shown in the accompanying drawing, which, with the exception of the forging in the center, he found on an electric vehicle in Chicago. The vehicle in question had a solid reach and no fifth wheel. The center piece was therefore not required.



The axle shown is light and strong and can be built at low cost. It consists of two straight iron bars 1½ x ⅜ in. and one bracing bar 1½ x ¼ in., bent as shown. The three bars are riveted together, as seen from the drawing. The center piece is a forging, bored to receive the pin of the reach. It is riveted to the axle. The steering knuckles are as usual.

Steering axles are very often made too weak. As a consequence the steering wheels spread and bind on the axle, resulting in a great loss of power.

The scheme to operate a line of horseless carriages in the parks and on Euclid Ave., Cleveland, O., has been abandoned for an indefinite period.

## COMMUNICATIONS.

### A "Dead Beat" Float Tank.

Reading, Pa., April 23.

Editor Horseless Age:

Your note following E. B. N.'s letter in your issue of March 28 suggests that a little story of our experience with floats may be of interest. In our earlier vehicles we used a pump for maintaining the gasoline level. The added complication with its added liability of getting out of order did not please us, although as a whole the system gave fair satisfaction. We therefore made many experiments to eliminate the pump, and we have used floats in the main fuel tank, in auxiliary tanks and in mixer chamber, and are now using a light float, cylindrical in shape and adapted to rise and fall in a cylindrical chamber, much the same as in the Longuemare, excepting that we have one moving part only. We found that in the main tank the float was affected by inequalities in the road, variations in grade, changes of speed or any other cause that disturbed the gasoline. We tried to overcome this by using globular floats and by using a multiple number of floats mounted on equalizers, none of which gave absolute satisfaction.

Our final form is very light, has no pivots or frictional parts, is concentric with its chamber and with the column of gasoline in which it floats. No variations in angle can affect it. The supporting column of the gasoline is so thin between the float and its concentric wall that its own friction prevents slopping, and being balanced by the concentric column of gasoline it cannot be affected by jolts, because the gasoline receives the same impulse as the float and one balances the other.

We consider it, therefore, a "dead beat." It is furthermore extremely simple—so simple that we look back on our long series of experiments and wonder why it took so long to reach this desired point. Yours very truly,

DURYEA POWER CO.,
By Chas. E. Duryea.

### Size of Wire for Spark Coil.

Editor Horseless Age:

Kindly advise me what gauge and quantity of wire to use for a jump-spark coil suitable for igniting a 1 h.p. gasoline engine running 1,000 revolutions per minute; also state whether silk covered wire is necessary, or will double covered cotton do, if run through a bath of molten paraffine?

R. H. B.

I should use about No. 12 or 14 wire for primary single cotton covered and soaked in paraffine, two layers. For the secondary I have used No. 36 single silk covered, about 3 miles, I believe. I wound on the secondary wire, carefully insulating each layer with a layer of tape or paper until the coil was about 3 in. in diameter. Too much care cannot, in my judgment, be taken in insulating the secondary, as on the insulation depends the efficiency of the coil.

E. J. STODDARD.

### A Race in Kansas City.

Kansas City, Mo., April 24.

Editor Horseless Age:

Kansas City is preparing for a grand motor vehicle race, to come off during the time of the holding of the National Democratic Convention here. We have written a number of motor vehicle manufacturers to this effect, and asking them to what extent they can furnish vehicles. We do not know of a time since the industry started when the chance for them to show off to the nation was greater. Thousands of people will take advantage of the low railroad rates to come and see the young giant city of the West.

We will be thankful for communications offering suggestions and advice from every lover of motor vehicles, from motor bicycles up. The scheme is to be an all-around, every-day affair for amateurs, with regular every-day vehicles. Will you spread the matter in your journal, so that we may be able to reach all manufacturers who will take an interest in what we hope to make the highest grade show ever made? The net proceeds will go to the fund for rebuilding our Convention Hall. Kansas City will put up the best she has, to the end that every one will be glad they came and took a hand. Very truly yours,

KANSAS CITY AUTOMOBILE CO.,
By M. C. Clark.

### Removal of Hasbrouck Motor Co.

The Hasbrouck Motor Co., of Newark, N. J., has purchased a site of 4 acres in the town of Piermont, N. Y., with a building 50 x 100 ft. in plan and three stories high, and they will remove to their new location about May 1. Power for the plant will be derived from a gasoline engine of the company's own build, which they say has been in similar service since they began business. In addition to their motor carriage work the company intends to build gasoline launches, and the location of the factory—not far from Sparkhill Creek—is most advantageous for this purpose. The entrance to this creek from the North River is just south of the "Long Pier" at Piermont, and affords a suitable anchorage for boats in process of repair. The New York City office will remain at 68 Broad St.

### Commendable Frankness.

Since winning the automobile race on April 14 Mr. A. L. Riker has been approached by a great many owners of electric traps with the remark, "Why can't you put batteries such as you used into my carriage?" He invariably says: "I can if you wish to get new batteries every time you go out." As explained before in this column, the batteries which won him the race were of a special kind and were fit only for a supreme effort. In no way would they stand ordinary road riding, for when they gave out all their power they themselves were "done up," which, as one can see, never would do for an automobile owner who wishes to get real service out of his rig. The lead plates of a battery built to be used often are of a thickness sufficient to prevent terioration before at least half a dozen months, according to the number of times they are discharged and recharged, but one discharge was all that can be expected from batteries which took Mr. Riker to victory.—N. Y. Mail and Express.

## OUR FOREIGN EXCHANGES.

### The De Dion-Bouton Piston.

MM. De Dion and Bouton have recently patented a novel and meritorious device for securing the wrist pin in their pistons. We take the following description and cuts from La France Automobile:

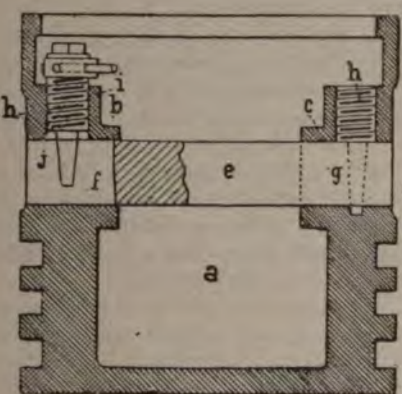



FIG. 1.

Fig. 1 is a section and Fig. 2 a side elevation. In both of these a piston is shown inverted as it would be for the purpose of securing the wrist pin in place. Fig. 3 is a plan of the wrist pin in detail. It will be seen from these that the wrist pin is slotted at each end in f f and drilled with the conical holes g g. The set screws are made with taper ends fitting into these holes, and it is evident that when the screws are set up tight their conical ends will spread the ends of the wrist pin in the piston. At the same time the ends of the set screws themselves are gripped so tightly that they are not likely to work loose; but for further precaution the pins k can be driven into the heads of the screws to lock them against turning.

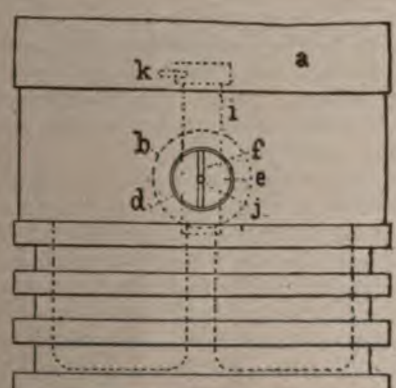



FIG. 2.

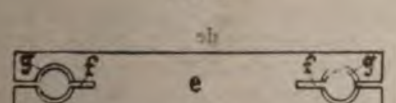



FIG. 3.

### Storage Battery Problems.*

By E. J. Wade.

Every one who has given any thought to the principles underlying the chemical storage of electrical energy must at some time or another have been struck by the extraordinary fact that in spite of the theoretical reversibility of every galvanic combination—and their name is legion—yet one and one only out of the whole number is commercially feasible, so that at the present day storage cells may at once be classified thus:

Practical: Lead—sulphuric acid—lead peroxide cells.

Unpractical: All others.

Such, however, being the state of affairs, it appears a fairly safe inference that this special combination must possess distinctive features not shared by any other, or at least by any other whose cost is not prohibitive, and on examination this soon proves to be the case.

Several noteworthy features, each contributing toward its success, might be cited; but the really unique characteristic of the combination as a whole lies in the fact that the electrodes, the active materials and the compounds produced from them are, under every normal condition of use, all insoluble in the electrolyte employed.

In every other galvanic combination with which commercial storage has been attempted, one or both of the electrodes or active materials have been soluble, and this solubility has in the long run invariably proved fatal. If a soluble negative is used, and the majority of the attempts made have been in this direction by substituting zinc for lead, the metal can only be redeposited effectively under certain conditions and for a limited number of times. If the positive is soluble, as for instance in the early attempt of Messrs. Thomson and Houston to adapt the Daniell cell to storage purposes, there is the additional trouble that its soluble salt inevitably reaches sooner or later to the negative electrode, where it is also deposited and sets up destructive local action. The latter objection, of course, applies to all kinds of fluid depolarizing agents.

For these among other reasons, the difficulties in the way of constructing successful storage cells with soluble electrodes have up till now proved insurmountable, while a second combination which follows the lines of the lead accumulator and only forms insoluble compounds at both poles yet remains to be discovered. So advantageous, however, to the electrical industry might be the results attending the introduction of an altogether new type of cell possessed of greater capabilities than those now in use, and so considerable should be the reward of its inventor, that the subject well merits further investigation and experiment in both directions; but I incline to the apparently paradoxical opinion that the solution of the problem, if any, will be an insoluble one. Also, I think that considering the extent to which the field has already been worked over, success is most likely to be attained by the utilization of some of the less studied and more obscure reactions into which the metals enter.

On turning our attention again to the lead—sulphuric acid—lead peroxide combination, the storage cell of commerce, a second remarkable fact encounters us. We find that although these cells have now been manufactured and used on a large

* Abstract of paper read before the Institution of Electrical Engineers, March 22d, 1900.

commercial scale for close upon 20 years, and during that time have been the subject of frequent laboratory investigations, it is not yet definitely settled what are the exact physical and chemical changes taking place in them. Now this is a most unsatisfactory state of affairs. If, as is not impossible, we may always have to depend on this one combination for all practical electric storage, it becomes of the greatest importance to determine whether its capabilities have already been developed to their utmost limits, or, if not, in what directions further advances are possible; but how can this be done without any certain basis to work from?

The last 15 years have witnessed more improvements in lead accumulators than might at first sight be apparent from an inspection of the cells themselves, for they have consisted not so much in any radical alterations of type as in a better understanding of the methods of treatment, the processes of manufacture, and the proper proportions and relations of the various component parts—a general readjustment, in fact, of many details all tending toward one common end, and resulting in an apparatus far better able to meet the requirements of its users.

On the other hand, there are indications that empirical experimenting has nearly reached its limits, for I do not think that many of these improvements have been made very recently. It is true that within the last few years there have been numerous attempts, as the Patent Office records bear eloquent witness, to reduce the weight of the cells in order better to adapt them for traction purposes generally, but more especially for use in electric automobiles. Time and trial have already pronounced their judgment on most of them. A few survive, but whether their sum total of usefulness shows any increase over earlier types appears to be doubtful. It has, of course, long been known that weight could be considerably reduced at the expense of life and durability, if circumstances rendered it desirable to do so; but unless the one factor is improved without depreciating the other, that in itself hardly constitutes any real advance.

In recent years the rapid advances made in our knowledge of physical chemistry have provided much evidence obtained from very different sources, such as the properties and behavior of alloys and of aqueous solutions, all tending to prove that substances may exist whose components do not apparently follow the law of combination in multiple proportions, and yet must in other respects be regarded as true molecular and chemical compounds. Of this nature are the compounds normally formed during the discharge, reversal and recharge of a lead cell.

From this basis of theory we can now proceed to the consideration of some points of more direct practical importance. In the first place, if it is true that the molecules of active material inevitably cease liberating the electrical energy when they are about 50 per cent. sulphated (giving on analysis 44 per cent. by weight of unaltered peroxide at the positive, and 40.5 per cent. of uncombined lead at the negative), owing to a sudden and large increase in their electrical resistance at that stage, then the actual performance of commercial storage cells approaches far nearer to the theoretically possible maximum than has hitherto been supposed.

If it could be effected electrically, the complete sulphation of 1 lb. of lead would liberate 118.5 ampere-hours, and the complete reduction to sulphate of 1 lb. of lead peroxide, 102.5 ampere-hours; but I consider that the real standard of perfection should be just half these values—that is, 59.25 and 51.25 ampere-hours respectively. (The figures for the peroxide are based on the assumption that its proportional composition is $PbO_2$; if it is hydrated its possible output will be slightly less.)

The active materials of well-designed and properly formed Planté type electrodes do, I think, often approximate to these outputs when discharging at low rates, say in nine to twelve hours; and, judging from the analyses of the positive paste in the e.p.s. cell tested by Professor Ayrton in 1890, the active material of Faure type electrodes is also capable of doing so; but in this special instance the previous treatment of the cell was exceptionally favorable, and as, on a 12-hour discharge rate, its capacity came out about 33 per cent. above its listed value, it had evidently been worked up to a state of efficiency but seldom attained, still less maintained.

In practice, pasted electrodes hardly ever give more than 30 to 40 ampere-hours per pound of positive or negative active material, while about half these values is probably a more usual figure, for, although the specific output of the active materials in new electrodes is often high, yet in many cases it decreases considerably with use, and if the electrodes are of faulty design or manufacture, or the cells not properly looked after, it may drop to almost any extent.

However, with all electrodes, whether of the Planté or Faure type, there is a very considerable falling off in the specific output of the active materials as the discharge rate is increased. The exact amount and curve of decrease varies with every different make of cell, but the best of them do not, at a three-hour rate, give more than two-thirds to three-fourths of their output on a 9 to 12 hour rate; while if discharged in 1 hour, their output is only about one-half, or even less. After all, then, there is still some considerable margin left for improvements in the ratio of output to weight, especially when rapid discharges are required, and these are often precisely the cases where a reduction of weight would be of the most importance and use, provided it were not effected at a sacrifice of durability.

It is evident that to obtain the maximum output from any active material the electrolyte must have access to each of its individual molecules so as to include them all in the electrolytic circuit, and its porosity therefore must be thoroughly molecular. That is to say, in addition to the spaces that exist between the small visible particles of material, each of these particles must itself be porous throughout. Most negative active material necessarily fulfils this condition, as the electrolytic reduction of the oxide or other insoluble salt employed must leave each molecule of lead surrounded by a space, also of molecular proportions, previously occupied by the other elements in combination with it.

The case of positive active material is somewhat different. If it is prepared from salts, such as lead sulphate or lead chloride, possessing about twice the bulk or half the density of lead peroxide, its molecular porosity is initially provided for just as it is in negative active material; but if it is obtained from litharge or minium or other compounds whose density is about the same as that of the peroxide itself, it is not, at first sight, evident how it can possess any porosity beyond the spaces between its visible particles, while if it is produced from solid metallic lead by a formation of the Planté type no porosity of any kind seems to be provided for. In all these cases, however, the materials before being peroxidized no doubt pass through an intermediate stage of partial sulphation, accompanied by a proportional increase in bulk, so that in this respect the conditions are to some degree the same as if lead sulphate had been the original raw material. That some such

growth of the positive active material does take place during its first formation is shown by the expansion of its support which almost invariably attends this process, whether the electrodes be of the formed or pasted variety.

But although the pores and spacing are there, they are quite inadequate to contain anything approaching the amount of electrolyte required for the full discharge of the active material surrounding them. Negative active material sufficiently porous to hold its own volume of liquid will have what is sometimes incorrectly called a "density" of 5.7 (half the density of solid lead, 11.4), or, as I prefer to term it, a 50 per cent. porosity, and this is a good average figure for the spongy lead in commercial cells. Lead peroxide being bulkier than lead, positive material is, as a rule, not nearly so porous, and a good average material will certainly not have more than a 33 per cent. porosity, or a so-called density of about 6.3 (two-thirds that of solid $PbO_2$, 9.45), and it will only contain one-half its own volume of electrolyte.

Now, solid lead requires about 24 times and solid peroxide about 16 times their volumes of dilute sulphuric acid, sp. gr. 1.200, for their 50 per cent. sulphation, with a fall of acid strength to sp. gr. 1.150, so that negative and positive active materials of good average porosity can only contain about 1-24th and 1-32d respectively of the quantity of electrolyte necessary for their complete discharge under these conditions. Even if the whole of the acid were abstracted from the solution in the pores, leaving nothing there but water, then the negative and positive active materials could respectively contain only about 1-8th and 1-11th of the necessary amounts of 1.200 acid, or about 1-7th and 1-10th if 1.300 acid were employed. These figures show very clearly how entirely the output of a lead cell is dependent on the diffusion of acid from the main body of the electrolyte into the depleted solution in the pores of its active materials.

It is impossible to say the exact proportions in which the different parts of the active materials will contribute toward the discharge current on first closing the external circuit, for this largely depends on the relative resistances of the electrolyte and the active materials themselves—a very problematic question. Lead in a solid state has only about one-twelfth the conductivity of copper, and in the porous condition its specific resistance is almost certain to be very much higher, but even then it is no doubt considerably less than that of the electrolyte; so, as regards the negative electrodes, the layers of active material nearest to the opposing positives will tend to supply more than their due share of the total current. On the other hand, although lead peroxide is one of the best conductors of electricity of any solid compound substance not entirely metallic, its specific resistance is of the order of a fluid electrolyte, and is probably higher than that of the ordinary acid solution in a cell; therefore, at the positive electrode it is possible that at first the inner layers of active material may discharge a little more rapidly than the others.

At both electrodes, however, the distribution of the work is also affected by other conditions, such as the nature and position of the conducting support, and, on the whole, it will be simpler and not much amiss to assume that the initial contribution of every molecule of active material to the discharge is approximately equal, provided that sufficient time has elapsed since the previous charge for the strength of the acid thoroughly to equalize itself throughout the pores.

But this state of affairs begins to alter immediately after the discharging has commenced. The diffusion not being sufficiently rapid to supply acid to all parts of the electrolyte as fast as it is being withdrawn by the active material, the solution becomes graduated into a series of layers or strata (assuming the active materials are of uniform porosity throughout) of different strengths, those layers directly adjacent to the surface undergoing practically no alteration, while the innermost layers will be the most weakened.

This change must necessarily be accompanied by a variation of the e.m.f.'s acting at different parts of the active materials, for it has been demonstrated by several researches that the e.m.f. of a lead-lead peroxide couple in dilute sulphuric acid depends on the strength of the electrolyte. Roughly speaking, it slowly decreases from 2.05 volts in 1.200 acid to 1.85 volts in about 1.030 acid, and then drops away rapidly to 1.45 volts, the e.m.f. of the couple in pure water.

—The Mechanical Engineer.

*(To be continued.)*

## The Races at Nice.

The following are names and times of arrival of the leaders in the several events of the Nice races, beginning March 25:

NICE TO MARSEILLES, 201 kilometers (125 miles).

Series A (Motor Cycles, Motor Bicycles and Voiturettes weighing less than 250 kilograms, or 550 lbs.).—Eighteen starters. First three: (1) Beconnais, 3 h. 23 m. 11 s. (Perfecta motor cycle); (2) Testé, 3 h. 44 m. 25 s. (De Dion); (3) Marceilin, 3 h. 46 m. 11s. (Perfecta).

Series B (Motor Carriages and Voiturettes from 250 to 400 kilograms or 880 lbs.).—Five starters. Winner: Clérissy 6 h. 7 m. 23 s.

Series C (Motor Carriages weighing more than 400 kilograms).—Twelve starters. First three: (1) René de Knyff, 3 h. 25 m. 30 s. (16 h.p. Panhard); (2) Gilles Hourgières, 3 h. 32 m. 1 s. (12 h.p. Panhard); (3) Charron, 3 h. 33 m. (16 h.p. Panhard).

René de Knyff's motor is said to be capable of developing 24 h.p., and the complete machine weighs a little over 2,100 lbs., or considerably less than an English 6 h.p. Daimler. It has been in use continuously since the Spa spring meet of last year. The above speed works out to a mean of a little over 36 miles per hour.

NICE—DRAGUIGNAN—NICE, 96 kilometers (59½ miles) each way.

Series A (as above).—Eight starters; four returned. Winner: Florès (Cottereau), 5 h. 32 m. 59 s.

Series B (as above, carrying two passengers).—Four started; three returned. Winner: Ravenez (Decauville), 4 h. 54 m. 29 s.

Series C (400 to 1,000 kilograms, carrying four passengers).—Three started; all returned. Winner: Chauchard (Panhard), 4 h. 45 m. 31 s.

Series D (over 1,000 kilograms, carrying six passengers).—Five started; all returned. Winner: Stead (24 h.p. Daimler), 3 h. 58 m.

MILE AND KILOMETER RACE.—The mile was made from a standing start and the kilometer with flying start. The best time was made by Beconnais, being 39 1-5 s. and 1 m. 18 s. for the kilometer and mile respectively. The former was at the rate of 57½ miles an hour. The motor was of 86 mm.

bore by 110 mm. stroke (3.44 x 4.4 in.), single cylinder. Among the voiturettes the best time was 1 m. 8 s. and 2. m. 3-5 s. for the kilometer and mile respectively.

At Salon Beconnais won the 100-kilometer (62 miles) road race to Arles in 1 h. 22 m. 34 3-5 s., and covered 73 kilometers 150 meters in the hour. Among the voiturettes Théry covered the 100 kilometers with a two-seated car in 1 h. 47 m. 47 3-5 s.

Besides the above there were two hill-climbing contests, and in one of these an accident occurred by which the driver of a Daimler car, Bauer by name, lost his life. By an error in steering he directed the car toward the rock wall bordering the road. He applied the brakes forcibly, with the result that the car appeared to spin around on itself, and he was thrown out, sustaining injuries about the head from which he died in a few hours. His companion escaped with slight injury.

## MINOR MENTION.

The Hub Motor Co., capital $1,500,000, has been chartered at Trenton.

The Atlantic City (N. J.) Council has fixed a tax of $25 on motor carriages.

Mrs. Dominis (ex-Queen Liliukolani) will take a Locomobile back from Washington to Hawaii with her.

Our contemporary, the Australian Coachbuilder and Saddler, celebrates its tenth anniversary in its March number.

The Empire State Automobile Co., of Rochester, N. Y., is about to be incorporated. Its capital stock is $20,000.

Henry C. Squires & Son, 20 Cortlandt St., New York, have established an agency for Locomobiles at 405 Park Ave., Plainfield, N. J.

The New Jersey Machine Works have received an order for one hundred sets of castings from the Smith Motor Co., of 52 M. & E. R. R. Ave., Newark, N. J.

The Whaley-Dyer Co., St. Paul, Minn., have lately completed a horseless carriage to run in Como Park. The motive power is gasoline, and the vehicle weighs complete 800 lbs.

Ralph L. Morgan, of Worcester, has sold his automobile patents to Charles S. Flint, of New York, and has entered Mr. Flint's employ. The plant will be located in New York.

After years of delay a wide-tire law has been enacted in Massachusetts. It does not go into effect till 1903, which will give ample time to all owners of vehicles to change their wheels.

Albert C. Bostwick, chairman of the racing committee of the Automobile Club of America, sailed for Europe April 25, to be gone till Aug. 1. In his absence David Wolfe Bishop, Jr., will be acting chairman.

Collier's Weekly for April 28 contains a long article on "The Automobile, or Horseless Carriage," by Prof. A. H. Thurston, of Cornell University. It is mainly historical, dealing with the early attempts at steam road locomotion in Great Britain.

The Philadelphia run of the Automobile Club will take place June 2, and the start will be made from the Waldorf-Astoria at 7:30 a. m. Dates for other runs were chosen as follows: May 5, to Babylon, L. I., starting at 9 o'clock; May 19, West Point; June 16, Bernardsville, N. J.; June 30, Asbury Park.

Columbia University announces a course in "Traction Engines and Carriages," which will treat the subjects of self-propelling road engines and cars, and automobile carriages. Prof. Frederick Remsen Hutton, dean of the faculty of applied science, who is also a member of the undergraduate automobile club, will conduct the new course.

Jefferson Seligman, of the Automobile Club of America, is projecting a stable for his motor carriages, to be the first of its kind in New York. It will resemble a carriage house, with an additional room for charging the batteries and quarters for two men. Mr. Seligman owns three vehicles—a victoria, a Stanhope and a brougham. With the horse stalls and hay loft dispensed with, the "stable" will have ample room for eight machines.

The Franklin Model Shop, 129 West Thirty-first St., owned by Parsell & Weed, is fitted up for the highest class of tool and model making. Their equipment is a modern one in all respects and includes machines of the best known makes. They make a specialty of developing inventions, preparing tracings of complete machines and carefully working out all the details of their design. All their work is in strict confidence, and on payment of their fee they waive all rights in any features of the invention which they may have proposed.

The motor tricycle race between Kenneth Skinner and Chas. G. Wridgway, at Woodside Park, Philadelphia, April 22, resulted in a rather easy victory for the latter. The race was for one hour. Skinner led from the second to the ninth mile, when his machine began to act badly. It was soon set right, but at the fourteenth mile it gave trouble again, and by the time it was started Wridgway led by 3 miles. On the twenty-ninth mile it blew out a valve and Skinner had to retire for good. Wridgway covered 38 1-3 miles in the hour.

The Paris-Roubais motor tricycle race of 268 kilometers (166 miles) was won by Baras in 3 h. 48 m., at an average speed of 69 kilometers or 43 miles per hour. The last 38 miles were over rough pavement. Béconnais ran Baras neck and neck for the first 40 miles, when his machine began to give trouble, and it was found on dismounting the motor that some one had put five small balls into the cylinder space. It is said that the fastest express between Paris and Roubaix makes the run in just Baras' time above, and that the route by rail is 7 miles shorter.

A company known as the Automobile Patents Exploitation Co. has been incorporated under the laws of New Jersey. Its object is stated to be the buying, selling, exploiting, marketing and financing of letters patent and other matters connected with automobiles. It proposes to acquire patents of all sorts connected with motor vehicles and will sublet rights to subordinate manufacturing companies. Some of the leading capitalists in New York City are back of this enterprise, but their names are at present withheld. The incorporators are H. A. Wise Wood, Thomas Russell, Thomas C. Clarke, O. C. Barber and Samuel P. Colt, each of whom takes two shares. The first meeting to elect directors will be held in a few days.

## The "Orient" Tricycle.

The following particulars, sent us by the Waltham Mfg. Co. regarding their motor tricycle, reached us too late for insertion in our last issue. They say:

"We fit it with either the Aster or the De Dion-Bouton motor of 2¼ h.p. Both of these motors represent the most popular and reliable makes of French motors at present manufactured, and give the most excellent results under all conditions. The dry battery which is used will last for about 4,000 miles and can be replaced at a small cost. The speed of the motor is increased and diminished by a lever, which causes the electric spark to occur when the piston is in different positions in the cylinder of the motor.

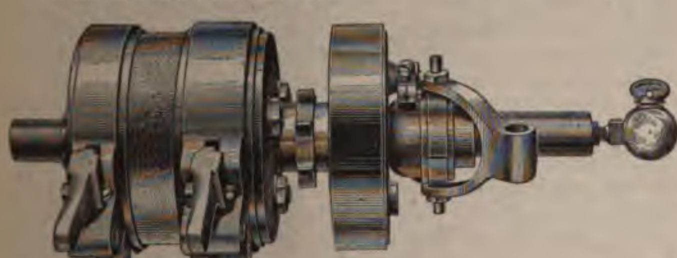
"When the machine is for use in an exceptionally hilly country the motor can be geared low enough so that the machine can surmount the steepest hills, and then again it can be geared quite high for good level roads. The rider can change the gearing of this machine with practically no trouble, and in a very short time. Owing to a clutch arrangement in the rear chain sprocket, the crank hanger gearing and chain remain stationary while the motor is in operation. One or two turns of the cranks start the explosions in the motor. The rider also has full control over the motor in the left handle bar grip, which opens and closes the electric circuit. The wheels are 26-in. and the tires 2½-in."

The "Orient" tricycle illustrated in our last issue was fitted with a De Dion outfit, not an Aster, as was erroneously stated.

## The Upton Transmission Gear.

The Upton Machine Co. is placing on the market a simple transmission mechanism for motor vehicles, of which we show an external view. The No. 1 size will transmit 4 to 5 h.p., is 15 in. long and weighs 35 lbs.

From the external appearance it will readily be noted that the transmission is accomplished (in some manner) through the medium of a system of spur gearing. A concise explanation is perhaps best given by figuratively taking it to pieces and describing each piece in detail. To commence with the shaft. It extends through the center of the gearing, and is made of one piece only. At either end it may be connected by half coupling directly to the motor shaft, or as an intermediate, by means of chains or spur gearing. Upon the transmission shaft, and an integral part of it, are the two pinion gears which are the direct drivers.



The disk furthest to the left rotates loosely upon the shaft, and by means of three studs placed equidistant from the hub, is the support of three small spur gears. These gears are in mesh with one of the pinion gears and an internal gear. By compressing the brake the disk is rigidly held and the movement of the pinion being imparted to and continued by the three spur gears, causes a reverse movement of the annular rack surrounding them. The rack is firmly fastened to a metal ring, a section of which would show a Z-shaped formation top and bottom; and the internal gear, being fastened to and inclosed by one side of the ring, the other side is used as a support for the casing holding the second annular rack, which is also flanged for a brake band, the casting revolving loosely on its support. Compression of the brake in this case holds the rack, and as the support of the rack also carries three spur gears in mesh both with the rack and the other central pinion, it will be seen that, the rack being held, the rotation of the pinion driver must be continued by the three spur gears, and the supporting studs around which the gears revolve, being not only attached to the Z or cone shaped structure, but also to the flange which carries the chain sprocket, it will be seen that the movement of the three spur gears is coincident with the movement of the sprocket, and the slow speed ahead is produced. The purpose of the sprocket or spur gear, should one be substituted, is to effect the connection with the rear axle. Next to the sprocket is a simple and efficient friction clutch. By this clutch the mechanism, in its entirety, is locked to the shaft and the fast speed is obtained. Lubrication is accomplished by putting a special oiling device on one end of the shaft, which is made hollow for that purpose.

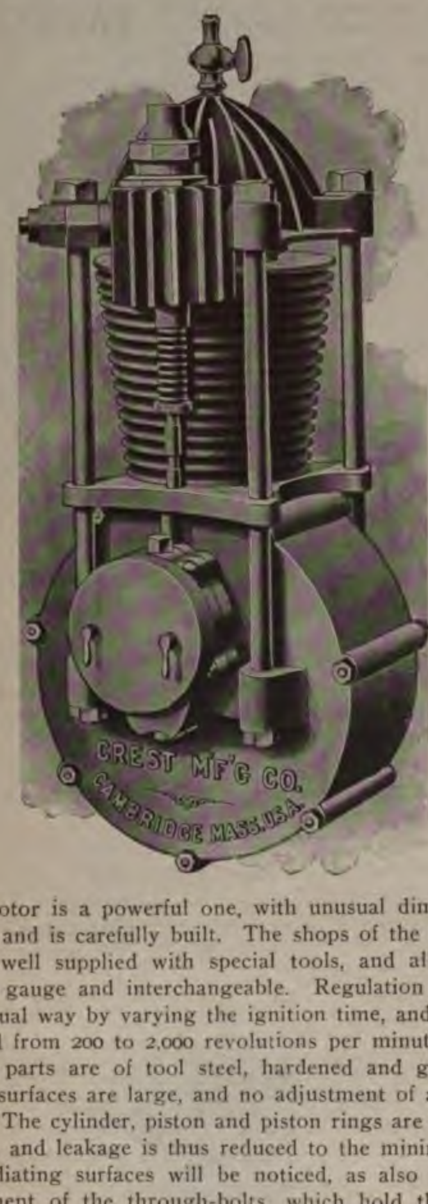
## The Acme Bicycle Motor.

Palmer Bros., Mianus, Conn., have brought out the light motor illustrated herewith, which is designed for attachment to bicycles. It is 12 in. high, weighs about 20 lbs., with aluminum crank case, and is said to develop 1 h.p. at about 1,000 revolutions per minute. It can be used in connection with a coaster hub brake by using a large sprocket on the rear wheel and small sprocket on the motor. The bicycle is started by pedaling, and this starts the motor. When the engine is started the cranks can be stopped and the feet allowed to rest on the pedals.

Palmer Bros. supply the castings for this motor to those desiring to build it themselves, and they say that a 10-in. lathe will take in any part of it. They supply likewise the finished motor, as also a carbureter, muffler, battery and spark coil.

## A New Tricycle Motor.

The Crest Mfg. Co., Dorchester, Mass., whose "Duplex" motor is familiar to our readers, is now introducing a single-cylinder, air-cooled motor, which will be of interest to manufacturers who build frames for tricycles and quadricycles and are looking for a motor.




The motor is a powerful one, with unusual dimensions of cylinder, and is carefully built. The shops of the Crest Mfg. Co. are well supplied with special tools, and all parts are made to gauge and interchangeable. Regulation is effected in the usual way by varying the ignition time, and speed can be varied from 200 to 2,000 revolutions per minute. All the working parts are of tool steel, hardened and ground; the wearing surfaces are large, and no adjustment of any kind is needed. The cylinder, piston and piston rings are finished by grinding, and leakage is thus reduced to the minimum. The large radiating surfaces will be noticed, as also the special arrangement of the through-bolts, which hold the cylinder head, cylinder and crank case in place.

The Crest Mfg. Co. are always ready to give information to their customers in regard to the best method of applying their motors to vehicles.

E. D. Williams & Co., Plymouth St., Jersey City, are offering to the trade samples of any style of casting in their phosphor bronze, thus enabling tests to be made of the quality and durability of the metal before orders are placed.

## An Oil Lamp for Automobiles.

We illustrate a new lamp for motor vehicles, which burns kerosene oil and possesses unusual illuminating powers. As seen in the cuts, it has a parabolic reflector whose edges extend well forward of the focal point, and the front consists of a moulded lens set in a door with polished flaring front. The back of the reflector carries a small lens of ruby glass, and the oil cup holds a supply for 24 hours. The bottom of the lamp is closed and the fresh air is drawn down through the annular space around the chimney, as shown by the arrows.

This serves the two-fold purpose of completely protecting the air supply from disturbance by the wind, and of warming the air before it reaches the flame, so that an unusually intense combustion and a brilliant flame are the result. Ordinary kerosene is burned, and the best results are obtained by using a high grade (150 degs. test).

R. E. Dietz & Co., 60 Laight St., New York, are the makers of this lamp.

## A New Dry Battery.

William Roche, 14 Vesey St., New York, inventor of the "New Standard" dry battery, is now making a special cell, which he calls the "7-inch Navy," for carriage motor ignition. He says that the trouble due to contraction of the active materials in larger cells is eliminated in this size. Mr. Roche informs us that a test of a "No. 2" cell, smaller than the above, gave the following results: At beginning of test, e.m.f. on open circuit, 1.5 volts; current on short circuit, 16.5 amperes. Rang a vibrating door bell for 211 hours, and then showed e.m.f. 0.91 volts and current 12.25 amperes. Another cell of standard make rang the bell only 39 hours.

Mr. Roche showed us an order received by him for 600 dry cells for the Newport Torpedo Station, to conform to specifications furnished. The specifications required an e.m.f. of not less than 1.5 volts and an internal resistance of not over 0.3 ohm; also that the cells should contain no acid which would cause deterioration on open circuit.

To introduce his "7-inch Navy" cell for ignition purposes Mr. Roche makes a special offer as to price, good for six weeks, which he will communicate to those interested.

**ACETYLENE MOTOR NUMBER IN JUNE.**

## More About Liquid Air.

Prof. Carl Linde, of Munich, the great authority on heat engines, and himself the inventor of one of the best of liquid air producers, frankly recognized its limitations in a recent lecture, in the words: "*If* liquid air cost nothing, and if it could be kept without loss, it would have great value." These "ifs" are the difficulties.

The present largest machines are able to make at the outside limit 1 lb. of liquid air per horse-power hour. We may ultimately attain a production of 2 lbs. per horse-power hour, this being very doubtful, but not absolutely impossible.

In the largest establishments its cost may be reduced to 2 cents a pound. At this rate the production of cold will cost fifty times as much as in a steam-driven refrigerating machine.

Loss by evaporation may possibly be reduced to about 1 per cent. an hour, even a slower rate having been obtained in the Dewar bulbs, which cannot be made of commercial size.

For motors liquid air can have no value except where cost is no object. It takes six times as much energy to liquefy air as the energy obtainable from the liquid air; there are further great losses in any machine, probably 80 per cent., so that only 1 to 2 per cent. of the energy spent to liquefy can be obtained again as work.

Professor Linde, however, suggests a possible use for liquid air in the gas or oil engine. In these engines the fuel, whether gas or oil, is mixed with air to form a gas which, by explosion, drives a piston. There are two drawbacks to these engines:

First—The heat of the explosion is very high—between 2,500 and 3,000 degs.—and to prevent the cylinder heating red, or even white, it is water jacketed and the heat led off. This jacketing carries off from 30 per cent. to 50 per cent. of the energy without an equivalent in useful work.

Second—While steam engines receive an impulse every half turn of the fly wheel, gas or oil engines receive an impulse every two turns. The first stroke is that of impulse or explosion, the second of expulsion of burnt gases, the third of indraft of fresh charge, the fourth of compression of the charge. Owing to the extreme heat and high pressures only one side of the piston is usually used. As a consequence gas and oil engines, although economical of fuel, are very heavy and require one or two heavy fly wheels to secure even motion.

If, instead of air, a few drops of liquid air were injected into the cylinder, together with the required oil, combustion at lowest possible temperature could be obtained and the water jacket losses would be minimized, and both sides of the piston could be used and a charge of liquid air and oil injected at every stroke.

Such a heat motor could probably be made more powerful for its weight and for fuel consumption than any motor ever built, and it would therefore have great value in certain automobile or other small motor work.

Cost must, however, be considered. A pound of oil costing 1 cent a pound requires for its combustion about 18 lbs. of liquid air costing a minimum of 2 cents a pound, and therefore, aside from the difficulty of either securing or keeping a supply of liquid air, the operating costs of such an engine, which is not a liquid air engine, but an oil engine, will be 36 times as great as the cost of an engine using atmospheric air.

Professor Linde sees no hope for the commercial use of liquid air, either for power, refrigeration or explosives, but thinks it may have value in surgery or to obtain an air rich in oxygen for certain chemical operations. The latter is at present the only probable field for its use on a commercial scale.—The Automobile Magazine.

# MOTOR VEHICLE PATENTS

# of the world

## UNITED STATES PATENTS.

No. 647,244—Automobile Vehicle.—James C. Anderson, Highland Park, Ill. April 10, 1900. Application filed July 31, 1899.

This invention is primarily an attempt to overcome the disadvantages arising from the rigidity of the framework of the motor vehicle as ordinarily constructed, and the endeavor is made in it to mount each of the four wheels in such a way that it shall be capable of yielding independently of all the rest to the irregularities in the road surface. An additional object aimed at is the articulation of the framework at a point in the center of the carriage so that the two sections, fore and aft, are hinged, as it were, and steering is effected by turning them relatively to each other.

Fig. 1.

Fig. 2.

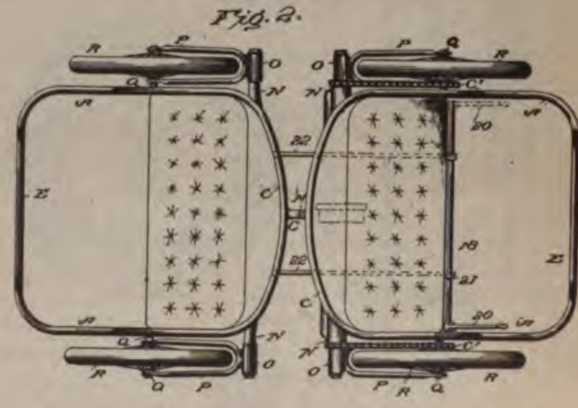
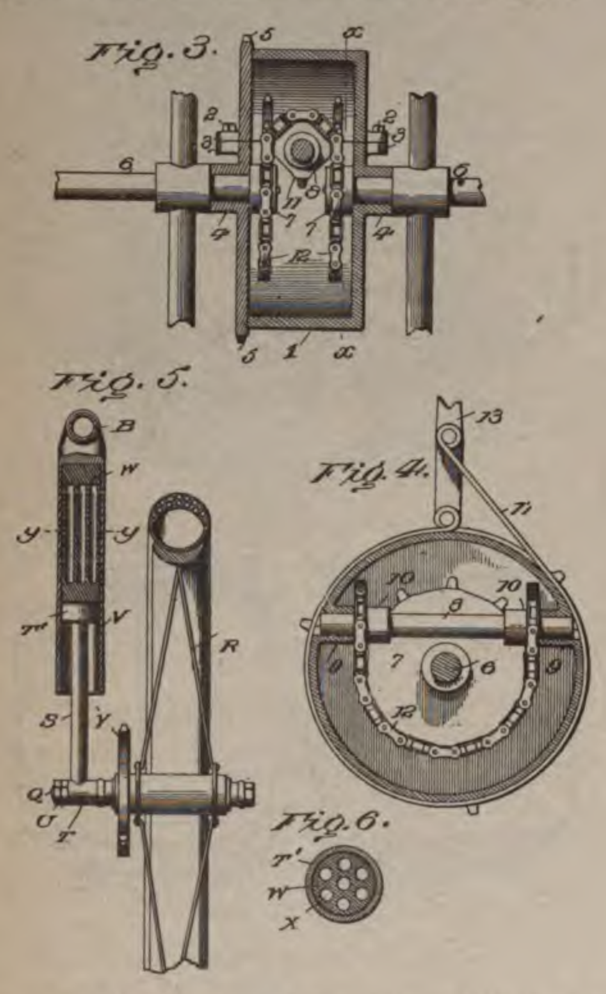


Fig. 1 is a side elevation of the proposed carriage, and Fig. 2 is a plan view. Each section of the frame is made in two parts, upper and lower, being respectively A and B in Fig. 1; and they are jointed together at G G by the vertical tubes F F'. The wheels are carried in forks, P P, which are pivoted at O O on studs, Fig. 2, and are free to oscillate vertically. The hubs of the wheels have bearings, as shown at T, Fig. 5, by which the weight of the carriage is carried

through the medium of springs in the tubes V. A special construction for these springs is shown, consisting of a rubber cylinder with longitudinal holes X, which are filled with compressed air and sealed, this forming the subject of a pending patent. A section of this rubber spring is shown in Fig. 6.

As seen in Figs. 1 and 2, the driving shaft is concentric with the pivotal bearings O of the wheel forks P, and the power is transmitted to the wheel hubs by the sprocket chains C'. A differential of special construction is provided in the driving shaft and is shown in section in Fig. 3. In this figure 6 6 are the two halves of the driving shaft, running in bearings in the frame. The sprocket wheels 7 7 are keyed to them, and a specially formed sprocket chain, 12, runs over the wheels 7 and also over the sprocket pinions 10. These pinions are mounted on a shaft, 8, which is journaled in the differential drum 1, as shown more clearly in Fig. 4, which is a section on the line x x. It is evident that when the shafts 6 6 turn at equal speeds there will be no rotation of the pinions 10 in the drum, but one or the other of them will act to drive the sprocket wheels 7 7 at equal speeds. If,



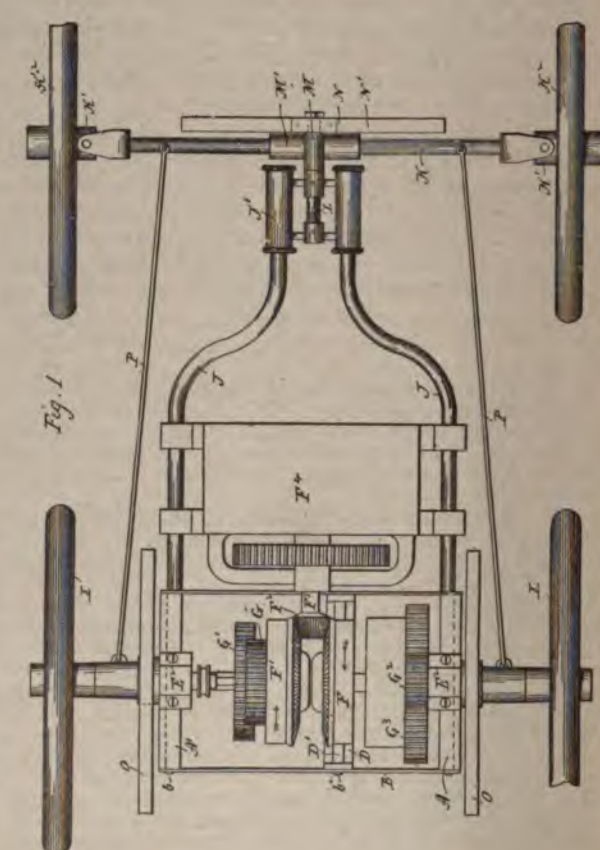

however, one of the shafts 6 6 turns slower than the other, as when a carriage turns a corner, the sprocket chain will run over the pinions 10 from one to the other of the sprocket wheels 7 7 at a rate corresponding to the difference in speed of the sprocket wheels. The differential drum is driven by a sprocket chain running over the teeth 5 5, or in any other suitable manner; and a brake band, 11, is provided on the periphery of the drum. Steering is effected by links or rods, 22, Fig. 2, which are jointed at one end to the framework A and at their other ends are jointed to rocking arms which extend, one upward and the other downward, from a rock shaft, 18, Fig. 2. A lever, 20, actuates this rock shaft, and it is evident that one of the rods 22 will push and the other will pull on the section A of the framework to which they are attached.

Additional claims are made of means whereby a single section of the frame, with the two wheels belonging to it, may be jointed to the front of the vehicle shown, and constitute a sort of forecarriage running on its own pair of wheels. In this case the forecarriage contains the motor and the rest of the equipment is merely a trailer. Provision is made also for steering the aggregation by a series of links, which push and pull each link of the chain by its due amount and no more.

Twelve claims.

No. 647,261—Frame for Motor Vehicles.—Walter Hay, New Haven, Conn., assignor to Emerson M. Hotchkiss, Waterbury, Conn. April 10, 1900. Application filed Aug. 14, 1899.

The principal feature of this invention is a "gear box," which connects the rear axle bearings and the rear ends of the reaches, and thereby becomes a member of the frame. This gear box is shown in sectional plan in Fig. 1 and in sectional elevation in Fig. 3, while Fig. 2 is the external side view of the gear box and frame.



The gear box contains the speed gears and the differential, which in this case is on the rear axle. The drawings show a particular arrangement of the gears consisting of a pair of bevel gears, F F', mounted on a single sleeve, which in its turn is mounted on the shaft E and is driven thereby by suitable means. The bevel driving pinion $F^2$ engages one or other of these gears F $F^1$, according to which is slipped into engagement with it; and two pairs of gears, one for normal use and the other for hill climbing, connect the shaft E with the axle C. The invention, however, does not claim this specific arrangement of the gears. The ends of the gear box are shown as castings, but they may be drop forged or even pressed or stamped from sheet metal. A case, B, of sheet metal is bent to their external contour and is secured to them, forming a rigid piece; and a removable cover, H, is added.

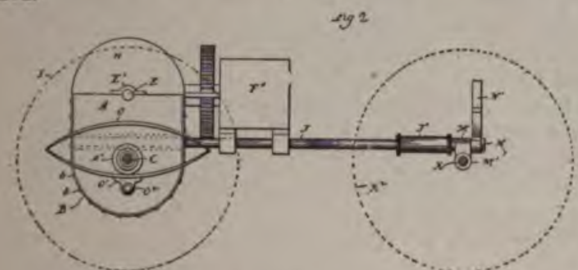
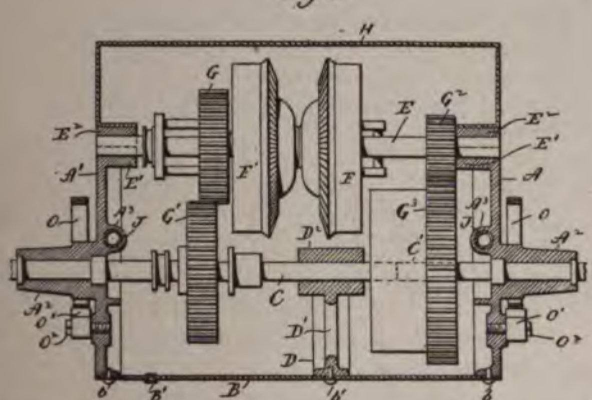


Fig. 3



The rear springs O O are mounted on spring blocks, $O^1$, outside of the ends of the gear box; and the reaches J J are rigidly secured to the gear box, being shown in the drawing as fitting into the sockets $A^3$.

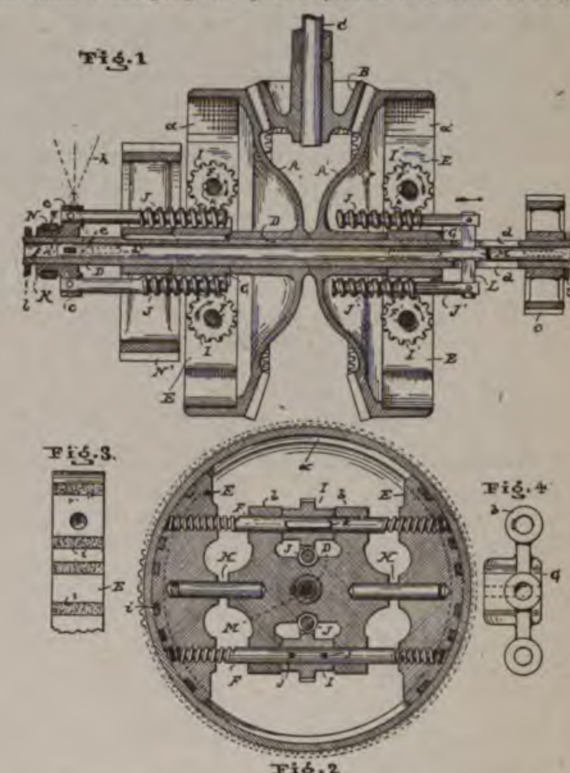
In addition to the gear box the invention comprises a special arrangement of the fifth wheel, which is likewise shown in the drawings. The forward ends of the reaches are connected by the forged jointings $J^1$ shown, and these carry a rigid stud, L, which projects forward and affords a bearing for the forged piece M $M^1$. This forged piece is made rigid with the front axle K and swivels on the stud L. The front spring $M^1$ is secured to the spring block M, which is mounted on the end of the stud L, so that oscillation of the front axle K does not affect the spring.

Any suitable means may be provided to relieve the stud L of shocks and strains due to obstacles striking one or the other of the front wheels. The means preferred for this purpose are shown in the stay rods P P, which connect the ends of the front axle with the rear axle bearings and are jointed at both ends.

Six claims.

No. 647,404—Driving Mechanism for Motor Vehicles, Etc. —Walter Hay, New Haven, Conn., assignor to Emerson M. Hotchkiss, Waterbury, Conn. April 10, 1900. Application filed June 17, 1899.

As will be seen from the drawings, this device is closely akin to that employed in connection with the speed changing gears of the De Dion-Bouton light carriage, illustrated in The Horseless Age of April 11. Instead of racks, square-thread screws, J J, are used to rotate the pinions I I, with the object of taking up lost motion by turning the screws. The shaft d carrying the power pinion o is hollow, and the




shells A A' run loose on it. The hubs G G (Fig. 4) have the arms b b forged on them to provide bearings for the screw shanks F F, to which the pinions I I are keyed. G G are keyed to the shaft d and carry the pins H H to relieve the screws F of strain in driving. The gripping shoes E E have inset strips of graphite or the like to prevent "cutting," and they slip freely in and out on the pins H as they are moved by the screws F. A rod, M, inside the shaft d, carries all four of the screws J on cross arms, L, projecting through slots in the shaft; and it will be understood that movement of this rod M in one direction tightens the clutch in the shell A, while movement of it in the opposite direction releases the clutch in A and tightens that in A'. All the pinions I I' turn simultaneously, and at the middle position of the rod M neither clutch is in engagement.

Seven claims.

No. 647,262—Operating Mechanism for Motor Vehicles.—Walter Hay, New Haven, Conn., assignor to Emerson M. Hotchkiss, Waterbury, Conn. April 10, 1900. Application filed Aug. 14, 1899.

This invention consists in the main of a combined speed regulating and steering lever, with a separate lever for engaging the hill climbing gear, constructed and operating as shown in the drawings.

Fig. 1 is an elevation, partly in section, of a vehicle with the proposed mechanism in place, and Figs. 4 and 5 are detail elevation and plan respectively of the operating lever. In the latter figures the handle lever (as it may be called) A is made forked at its lower end and jointed at B to the skeleton operating lever C, and also to the arm D D′, which is fast on the vertical tube E. A toothed dog, $F^2$, on the end of the stem F, is held by the spring $F^3$ in normal engagement with the notched segment G, which is formed on the upwardly bent rear end of the skeleton lever C. With the dog in engagement the levers A and C move as one piece, and the purpose of the segment connection between them is to allow of the handle lever A being higher or lower, at the convenience of the operator.

Fig. 4

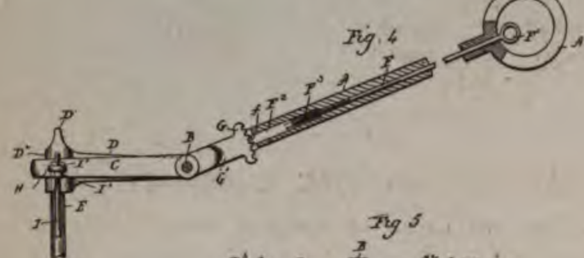
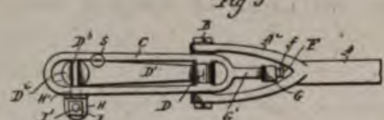


Fig. 5



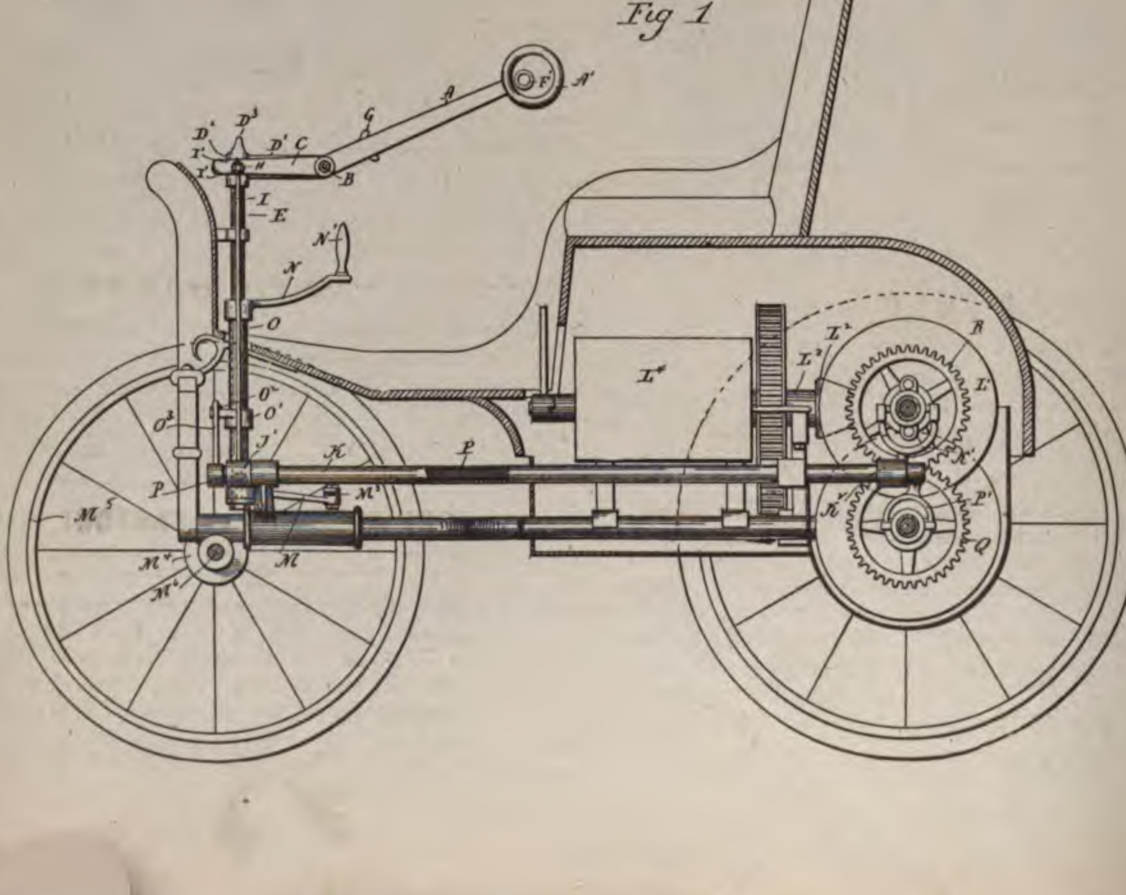
The upper end of the rod I is connected to C by the adjustable lock nuts and pivot joint shown. This rod I at its lower end connects to the end of another lever, whose hub J′ is fast on the forward end of the straight tube K; and by raising or lowering the handle lever A this lever is made to impart a rocking motion in one or the other direction to the tube K. This tube K carries at its rear end a clutch operating fork, K′ (Fig. 1), which operates a speed changing clutch of any suitable design. Movement of the handle A A′ in a verticle plane, therefore, controls the vehicle's speed. Steering is effected by moving the same handle in a horizontal plane; and to this end the vertical tube E is mounted in bearings and carries the lever M at its lower end. The links or rods from the ends of the steering axles connect to this in the usual manner.

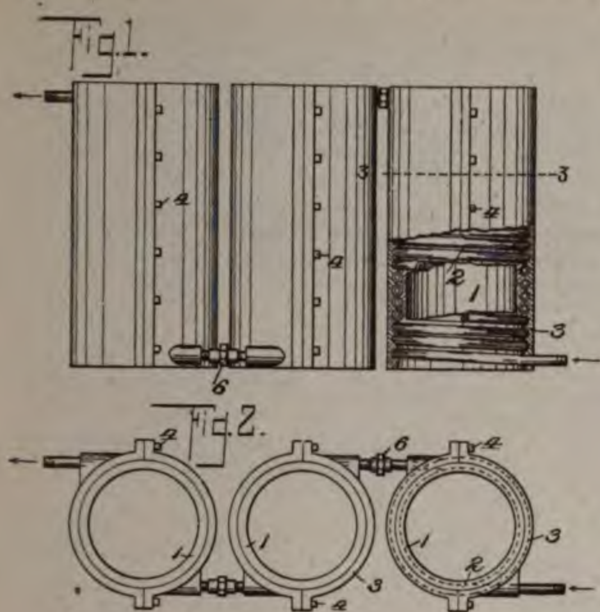
The handle N controls the hill climbing gear. It is mounted at the top of a sleeve, O, to which a lug, O′, is made fast; and the latter actuates the short lever $O^3$ through a link (not shown). The lever $O^2$ is fast on the front end of a rod, P, which extends through the tube K and carries another clutch operating fork, P′, at its rear end. The speed changing clutch operated by K′ is on the countershaft and the hill climbing clutch is on the axle.

In Fig. 5, S is a lock for locking the lever C to the arm D at the neutral position of the former, so that the vehicle cannot be tampered with in the absence of its driver. Projection $D^3$ is to support the handle lever A when the latter is thrown over forward to give access and egress from the carriage.

Fifteen claims.

Fig 1

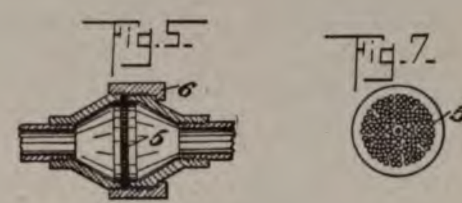





No. 647,495—Steam Generator.—Robert W. Jamieson, Rochester, N. Y. April 17, 1900. Application filed June 24, 1899.

This is an arrangement of flash boiler for superheated steam, with special arrangement for breaking up the particles of water which assume the spheroidal state, in which condition they boil away very slowly. The water tube, of copper, is encased in the split cylindrical shells or jackets, which receive and conduct the heat. The device for breaking up the water is shown in Figs. 5 and 7, and consists of perforated baffle plates, 5, in enlarged sections of the pipe. For convenience they are placed in the unions 6, which are specially formed to receive them.

Fifteen claims.

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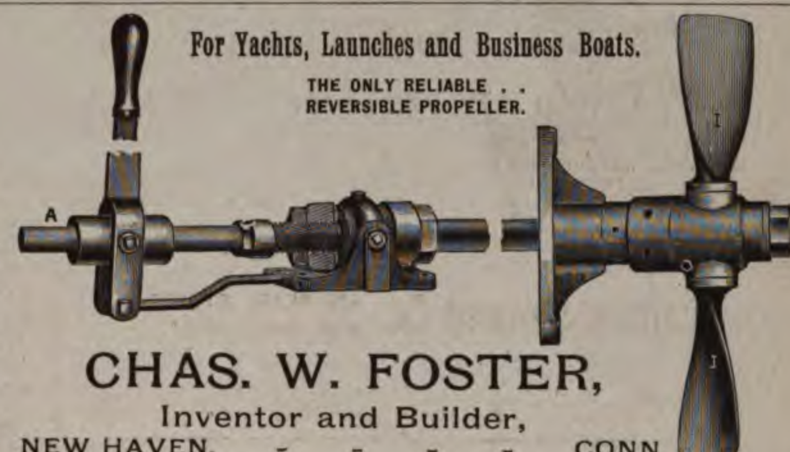


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# THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. VI. NEW YORK, MAY 9, 1900. No. 6.

## THE HORSELESS AGE.

**E. P. INGERSOLL, Editor and Proprietor.**

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## The Inventor's Task.

Editor Horseless Age:

Is there any opening for one who has made a lifetime study of mechanics and several years' study of gas engines? I think I have good ideas, and if my expenses were paid and some inexpensive tests made, I think that within a few weeks I could prove myself practical. MACHINIST.

The above letter is one of a kind which, with variations of theme and presentation, comes to us now and then with a request for personal reply. We wish that we could help the authors of these letters, because we know that to them the matter is a serious one; but we hope that we shall not offend them if we say that their question is a good deal as if some one, having acquired a small telescope, should write saying that he had decided to discover a comet, and that he wanted to know the best way of going about it. There is no royal road to the discovery of a comet, and there is none to the position of expert, whether in gas enginery or in anything else. In no branch of mechanics, perhaps, are "good ideas" so plentiful as in gas engine work, and in no branch are they at such a discount, unless backed by long and practical experience.

In principle the gas engine is the most tempting of thermodynamic propositions; its "fatal fascination" has lured many an inventor to his undoing. In practice it is the most intricate and difficult of propositions to embody, and the most alluring "ideas" about it are often the hardest to bring to earth. It was years before the hot tube supplanted the igniting flame; and the perfect electric igniter has not yet been invented. We are credibly informed that a company of the highest standing in another line not long ago spent $40,000 in attempting to put on the market a kerosene engine of what they believed to be the most approved design; and they had finally to withdraw it and charge the outlay as a dead loss. The Patent Office is overburdened with good ideas about gas engines—ideas most of which never lived to outgrow their swaddling bands, and never could.

The best course for a would-be inventor of gas engines to pursue is, first of all, to enter the shops of some good company which builds them and learn all he can. If, as is probable, he has already done this, he should next read everything he can procure access to which has a bearing on the subject. He will probably find that all his own ideas have been anticipated and tried by others; and if (as is not unlikely) they have failed and disappeared, he must set himself to find the reason. Having learned everything that present practice or past endeavor can teach him, he is then in a position to demonstrate his own ideas, now somewhat matured, by building an experimental machine.

This, it will be seen, is really the crux of the whole matter, since most aspirants for the inventor's reward lack the time or the money, or both, to put their ideas to this practical test. It is an absolutely necessary preliminary, however, both because there are already so many inventions going a-begging that an untried newcomer could obtain no hearing, and because the inventor will be either exceptionally gifted or exceptionally fortunate if he does not build two or perhaps three

such machines before he realizes his aim. The requirement may seem a hard one, but it is just and necessary, and it is doubtful if the exceptions which occur now and then, wherein the inventor experiments at the investor's expense, often result in benefit to either party.

After all, it is simply the law that the fittest must survive, and no owner of a really meritorious invention, if he possesses the ability to develop it and the energy to push it, will need to fear lest his idea will be smothered for lack of opportunity. So long as competition exists between investors, there will be no lack of room at the top for the inventor.

## The Moral of it.

We presume that many of our readers could duplicate to some extent the experiences related by "Steam Carriage" in another column. It would be unfair to the author of that extremely candid letter, however, to jump to the conclusion that because his first vehicle was a disappointment, therefore steam carriages as a class should be shunned. Indeed, "Steam Carriage" declares himself still in favor of that motive power; and whatever the ultimate verdict may be, there are plenty of arguments in favor of his preference. Many a novice with a gasoline vehicle could tell a story equally long about his difficulties with the igniter, the vaporizer, the batteries, the valves, and what not besides; and the choice between the two powers will be determined not only by the service intended but by the mechanical preferences and experience of the user.

But although some of "Steam Carriage's" mishaps were chargeable only to inexperience, there remains a substantial residuum to invite the studious consideration, both of that particular vehicle's builders (who will doubtless recognize their product) and of others who would profit by their errors. It must be admitted that our correspondent's standard is high, little short, indeed, of perfection itself, which we all know to be unattainable, although "Steam Carriage" professes an intention to look for it. Opinions will be likely to differ as to how far the supplying of duplicate or substitute parts should be carried. Gauge glasses should obviously be included, and ought to make try cocks unnecessary. It is not evident why any substitute for the feed pump, other than a hole and a plug, should be on the list. *A fortiori*, a spare chain should be added, too, and also a spare regulator, spare connecting rod, piston rings, torch (of course), and an axle or two; or else a horse should be taken in tow, as a simple equivalent for all of the above. To us it would seem better to make the feed pump, with its lever and valves, sufficient for its work, and then to take the chance of breakage from external causes.

There is no denying that a construction which permits glands and other parts to unscrew without notice on a motor vehicle is little short of a mechanical scandal, and deserves the severest reprehension. It is not so clear that the engine and boiler ought to be bolted to the frame instead of to the body. They should be rigidly connected, of course, but the change proposed would increase the road vibrations and shocks to which they would be subject, and moreover, by throwing so much additional dead weight on the tires, would materially shorten the latter's life.

It is somewhat surprising at this date that any steam vehicle should be put on the market without a variable cut-off. This single fact would go far toward explaining the discrepancies between the economy claimed and that realized in our correspondent's carriage, since any engine with fixed cut-off works most economically when running at top speed with the throttle wide open. This could and would be done for the purpose of making a mileage record; but it is not to be expected that the purchaser of the carriage will habitually set the law at naught in order to save his gasoline.

The proposed motor vehicle race in Kansas City, announced in another column, deserves to succeed. There could not be a better time to bring the horseless carriage before the public than during the coming national convention there, and all builders interested in the Western trade will find in that event an excellent opportunity to show what they can do.

## The 1,000-Mile Trial in England.

The event of the year in England is the 1,000-mile trial, which began Monday, April 23, and is to end May 12. It is in no sense of the word a race, and the Automobile Club of Great Britain, under whose auspices it is being held, has enacted strict rules to prevent racing or any speed above the legal limit. This is made necessary by the purpose of the "trial," which is to demonstrate to the public the practical utility, safety and endurance of motor vehicles; and it is recognized that to provoke the resentment of other users of the road, many of them unused to and perhaps prejudiced against the new locomotion, or any accidents, would hurt or destroy the moral effect aimed at. To this end an itinerary has been mapped out, starting at London and taking in Bristol, Birmingham, Manchester, Carlisle and as many of the towns as possible, to Edinburgh, from which a return route goes through Newcastle, York, Leeds, Sheffield, Lincoln, Nottingham, etc., to London again. Stops are made at seven of the principal cities for the purpose of exhibiting the vehicles, and several hill-climbing contests are held en route.

There are 81 entries, some by manufacturers and others by private owners. The most difficult hill-climbing contests occurred on April 30 and May 2, up Shap Fell and Dunmail Raise respectively. The best time up the former was made by the "Empress" tricycle of 2¾ h.p., owned by Herbert Ashby, which made an average of 14.4 miles per hour. C. S. Rolls' 12 h.p. Panhard-Levassor came next with 13.2 miles per hour, and 25 other competitors made the ascent at rates varying down to 3 miles per hour. Up Dunmail Raise Mr. Rolls' car made the best average, which was 17 miles an hour. Birkhill afforded another severe test, and here again Mr. Rolls' car led, this time at the rate of 16 miles per hour. The Locomobile carriage climbed the hill at the rate of 10½ miles, which was its best showing thus far.

## The Goodsell Bill Passed.

The Goodsell bill has received the Governor's signature and become a law. It authorizes any corporation that has operated a stage route continuously for five years last past, in any city of the first class (New York or Buffalo), to extend its routes in any direction without further authority than the approval of the State Railroad Commissioners. The Fifth Avenue Coach Co. is the only corporation in this city to which the provisions of this law could possibly apply, and there is no concealment of the fact that the law was enacted expressly in the interest of the Fifth Ave. stage line. All of the stock of this line is owned by the New York Electric Vehicle Transportation Co., and the absolute control of the last-named company now rests with William C. Whitney and those persons associated with him in the Metropolitan syndicate.

With the exception of the approval of the State Railroad Board the Fifth Avenue Stage Co. in extending its lines requires "no further authority, proceeding or consent, under any act, general, public, private or local." The new law furthermore gives the stage company "the right to charge a fare not exceeding 10 cents per passenger for a continuous ride over the whole or any part of the routes owned or operated by it." The company must pay a license fee to the city equal to the charges now in force for licensing similar stages and omnibuses, and it must also pay to the Comptroller of the city 5 per cent. per annum of its gross receipts.

It is the purpose of the Whitney syndicate so to operate this stage line that it will supplement the transportation facilities of the Metropolitan Street Railway system. A representative of the Fifth Avenue Coach Co. told Gov. Roosevelt that it was intended to expend $500,000 at once in perfecting the stage service on Fifth Ave. alone. Double-deck automobiles of unusual size are to be ordered for this purpose. In a general way the policy of the company will be to give a transportation service through much frequented highways not supplied with street car lines, and special lines of stages, it is said, will be run to places of public interest remote from the lines of the street railway system.

## Duryea Power Co. Settled.

The Duryea Power Co., of Reading, Pa., has lately increased its capital to $100,000, and has moved into permanent quarters at North River and Hockley Sts. Here they have 10,000 ft. of floor space, well lighted, ample power, with testing ground for their vehicles in the rear, and anchorage for their launches on the canal in front.

The officers of the company are Herbert M. Sternbergh, president; Chas. E. Duryea, vice-president; Henry Milholland, secretary and treasurer, and their goods are being built under license from the Duryea Mfg. Co., of Peoria, Ill. This arrangement secures to this company the services of Chas. E. Duryea, the pioneer gasoline motor vehicle builder of this country.

Work has already been pushed forward in temporary quarters with the Reading Cycle Co., so that the first lot of vehicles will be finished early next month. The company prefers and recommends the three-wheeled type of vehicle, but builds four-wheelers to order.

## A Club in New Jersey.

A North Jersey Automobile Club has been organized in Paterson, N. J., with a membership of nine. The officers are: C. D. Cooke, president; Vernon Royle and J. E. Barbour, vice-presidents; E. T. Bell, Jr., secretary and treasurer; W. Fletcher, captain. The club is formed with the same objects in view as the Automobile Club of America, but expects to make a special feature of weekly club runs. The secretary would be glad to learn from automobilists in all the neighboring New York and New Jersey towns the addresses of shops in their towns which could make automobile repairs, where gasoline can be purchased, and the names of the best hotels and restaurants. Also addresses of stables or other possible storage places for automobiles. This information will be properly collaborated and a copy will be sent to automobilists who have aided in obtaining it and to others on request.

## The Legal Status of Motor Vehicles.

We are in receipt of a brief pamphlet by Fred D. Stanley, a lawyer of Boston, entitled "Motor Vehicles in the Public Streets and Highways; Their Legal Rights and Liabilities." Originally written as a contribution to a larger volume on the motor vehicle industry, it has been reprinted repeatedly at the request of the author's professional friends, and to any who are interested in the legal aspects of the subject it will be of much value. The author reviews numerous statutes bearing on the subject, and quotes opinions delivered in over a score of cases involving the use of streets and highways in unusual ways.

After pointing out that the motor vehicle is not in itself new, and that the bicycle had to face a few years ago the same kind of opposition now raised against the motor vehicle, the author goes on to define highways and streets, showing that the former includes the latter, and pointing out that "a municipality has no authority over the streets within its territorial limits, except such powers as are delegated to it by the Legislature, and in no case can it exercise dominion beyond those powers." The streets and highways being for public use, except as restricted in dedication or by statute, no particular mode or modes of locomotion can be favored thereon by the municipality. This, however, does not debar the municipality from enacting such regulations of traffic as are necessary for the general advantage; but it debars total prohibition of anything not demonstrably a nuisance. "The drivers of horses have no more rights in streets or carriage ways than those using other common modes of conveyance, and the mere frightening of horses is neither actionable as a tort nor complainable as a nuisance, nor an obstruction which city officers or public boards are accountable for." "Some horses are frightened at a piece of paper, others are not. * * * Some horses are frightened at bands of music, others are not, but it is a recognized principle of law in this country that no action can be sustained against a municipality that permits bands to march through its streets, by reason of which some horse may become frightened and occasion damage."

The action of the Park Boards of Chicago, Philadelphia and the other large cities with regard to motor vehicles is reviewed historically and critically, and the conclusion reached is that such boards have the right to impose reasonable restrictions on the use of motor vehicles within their domains,

Belgian correspondence of a recent number of La France Automobile that this firm, although not abandoning the manuufacture of combination vehicles, will henceforth devote its attention principally to gasoline vehicles.

A system which at first sight closely resembles the preceding one is that exploited by one of the American electric vehicle companies, and consisting of gasoline engine, dynamo, storage battery and motor or motors. The system was contrived for street railways, in the first place, but its application is now to be extended to heavy automobile vehicles. It differs from the combination system in that the engine is not mechanically connected to the drive wheels, and the whole energy of the engine is first transformed into electrical energy in the dynamo, and then retransformed into mechanical energy in the motor. Part of the electrical energy from the dynamo passes (under favorable circumstances) into the battery, where it is transformed into chemical energy. When the circumstances are less favorable, this energy is retransformed into electrical energy, in which form it flows to the motor, where it is transformed into mechanical energy. Part of the energy of the engine undergoes therefore a double and part a quadruple transformation before it can be transmitted to the wheels. The efficiency of the double transformation would not be more than 60 per cent., while that of the quadruple transformation would hardly exceed 40 per cent., which gives a mean of something like 50 per cent. Granting an efficiency of 80 per cent. for the gearing, we have for the total efficiency from engine to drive wheels 40 per cent. Such vehicles require, therefore, an engine of enormous power, comparatively speaking, if the storage battery is to remain charged.

[The illustrations (Figs. 1 and 2) show two types of combination vehicles, both of them with the armature on the engine shaft. It will be seen that in both the armature is made to serve as a fly wheel.—Ed.]

## Some Sensible Advice.

The following letter, by a well-known English "motorist," was printed in the Times last October. Some of the English papers have lately thought it worth republishing, and its suggestions are certainly as applicable on this side of the water as on the other.

To the Editor:

Sir.—As one continually reads letters in the various newspapers of the terrors of motor cars in the public highway, if you will allow me to trespass on your valuable space it may not be out place if I, as a master of foxhounds, a large owner of horses and an enthusiastic automobilist, write a few lines on the subject.

Horses hate motor cars; I know they do; but these same quadrupeds hate anything and everything the least unusual. To train a horse not to mind a motor car is simplicity itself, and perhaps my own experience will be the easiest way to explain the remedy.

In October last I bought a Beeston motor tricycle. Most of my horses were frightened at it, some terrified, but their terrors soon disappeared.

I had all the horses exercised close to the carriage drive here and used to ride the tricycle up and down in front of them. In a few minutes half of them took no notice, and the other half soon got right. One horse in particular, a cart horse, was the most difficult to manage; he would not go near the tricycle, so I had him ridden round the machine in a field, getting closer and closer, till at last he would stand with his nose over the engine.

Many people will say, "This is all very well, but I cannot borrow a motor car to train my pony, and I think motor cars are the greatest curse to the public in general," etc. To these gentlemen I would answer that the Queen's highway was not wholly constructed for him and his fat pony, and if he would spend half the time he spends grumbling and writing silly letters to the papers training his pony, he would find his drives more pleasant to himself and be less of a nuisance to the motorist, only too willing to be good natured.

Now, I beg to suggest how he may spend this half time—that is, go to the yard of some motor depot, or some private owner, ask to have motor engine started, and lead the pony quietly up to the machine. Do not job him in the mouth and frighten him, but walk him quietly up to the engine.

Yours, etc.,
HERCULES ROBERT LANGRISHE.
Knocktopher Abbey, Co. Kilkenny, Ireland.

## Gas Engine Design.

The diagram on the next page will enable one to read at once without calculation the relative volumes for a given compression, or the compression for a given ratio of volumes, and also the approximate explosion pressure (maximum) in an Otto cycle gas engine cylinder.

In the diagram the vertical scales represent pressures and the horizontal bottom scale represents the ratio of the volume at the end of compression to the volume at the beginning of compression. The scale at the bottom, it will be noticed, is in tenths (numbered) and hundredths.

The relation between the volume and pressure during compression is expressed by the line A B, which is to be read by the right-hand scale at the left of the figure.

The line C D gives the approximate explosion pressure corresponding to a given degree of compression, when read by the left hand scale at the left of the figure. All pressures are absolute.

### METHOD OF USING.

Suppose we desire an engine to have a ratio of volumes of 1 to 4 and want to know what the compression pressure will be and what explosion pressure may be expected with a proper mixture under favorable circumstances.

At the point a, corresponding to .25—that is, two-tenths and five-one-hundredths—erect a perpendicular, a b, cutting the line A B at b. From b draw a horizontal line to the left, and note that it cuts the right-hand scale at a point corresponding to 89 lbs. The latter figure (89 lbs.) is therefore the absolute compression pressure.

Of course if the compression pressure is known and it is desired to find the corresponding ratio of volumes, the above operation would be reversed—that is, one would draw a horizontal line from the point of the scale indicating the pressure, to cut the line A B, and from the point of intersection drop a vertical line upon the scale at the bottom. Such vertical line will cut the scale at the point indicating the corresponding ratio of volumes.

To find the approximate explosion pressure, continue the line corresponding to a b upward, cutting the line C D in c. From the point c draw a horizontal line to the left, to the left-hand scale. Said line will cut the scale at the point indicating the explosion pressure to be expected under favorable circumstances. In this case it is about 310 lbs. absolute or 295 gauge.

This diagram is an advance sheet from a pamphlet with the above title, which is being prepared by Messrs. Parker and Burton, patent lawyers, of Detroit, Mich., for free distribution. The work is under the editorial charge of Mr. E. J. Stoddard, who will use every effort to make it of genuine value to those who are still, as he has been for several years, engaged in this line of engineering.

A letter or a postal to the above address, with the distinctly written or printed address of the sender, will secure one of the first copies.

## COMMUNICATIONS.

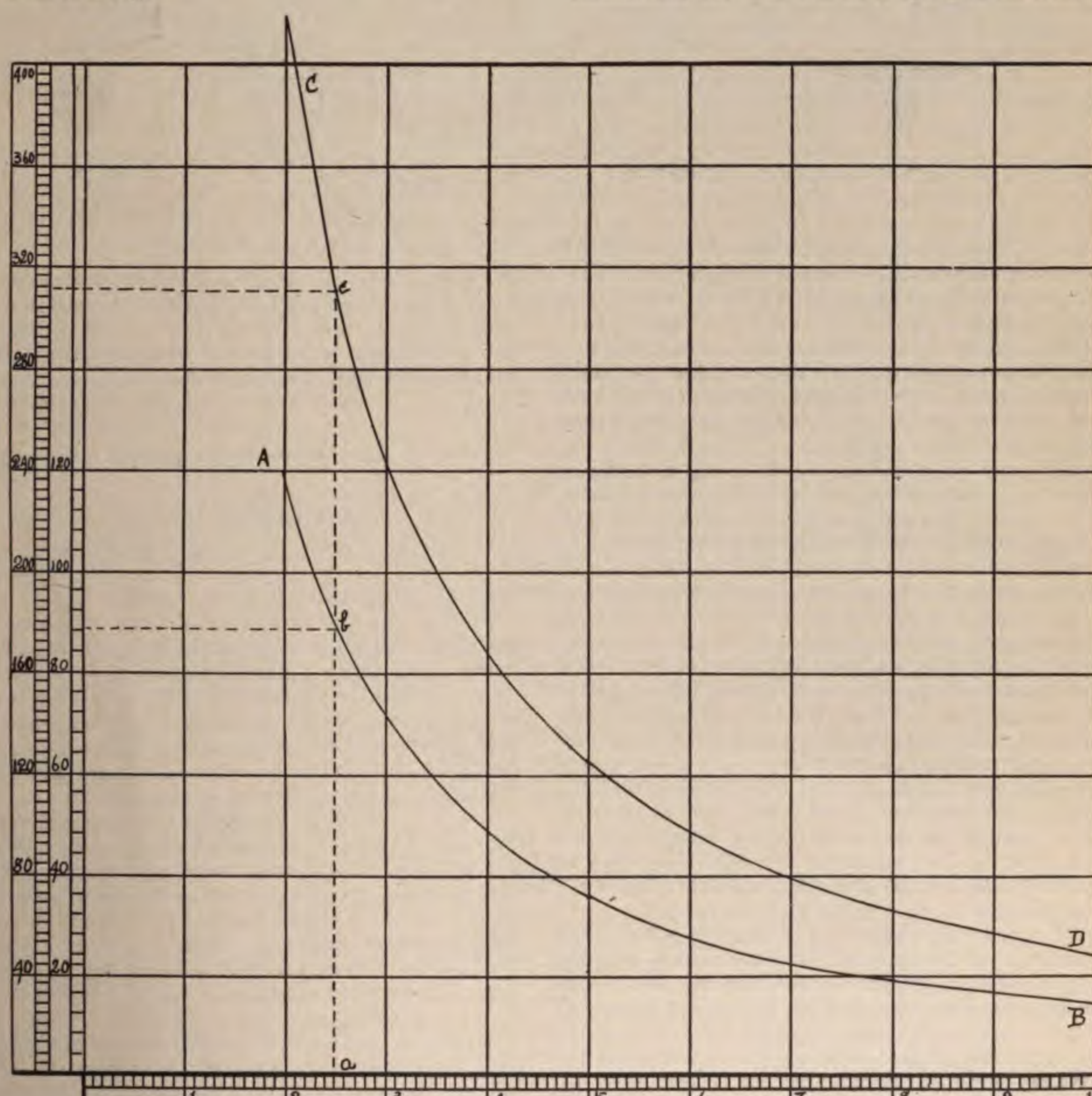
### Suppressing the Reach.

New York, April 30.

Editor Horseless Age:

The suppression of the reach, to which attention is called by P. M. Heldt, is a movement in the right direction, at least so far as gasoline vehicles are concerned, and with the consequent use of semi-elliptical springs has some advantages besides those enumerated by him.

A carriage having elliptical springs on the rear axle and one of the same design over the front axle, has only three points of support for the framework or body carrying the motor, transmission, etc. One with an X spring on the front axle is




CURVES OF GAS ENGINE PRESSURES.

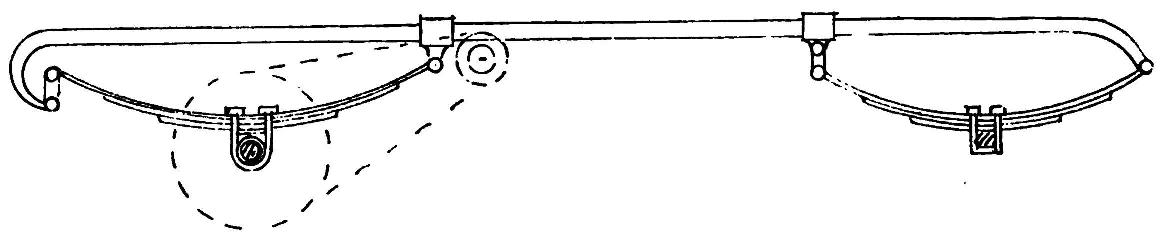


Fig 1

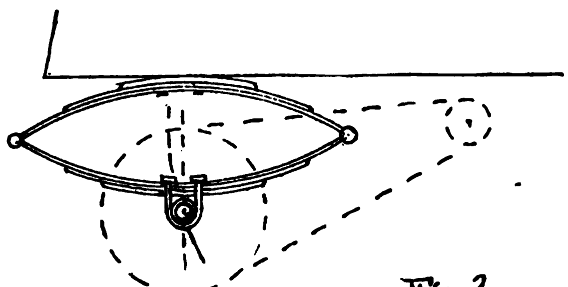


Fig 2.

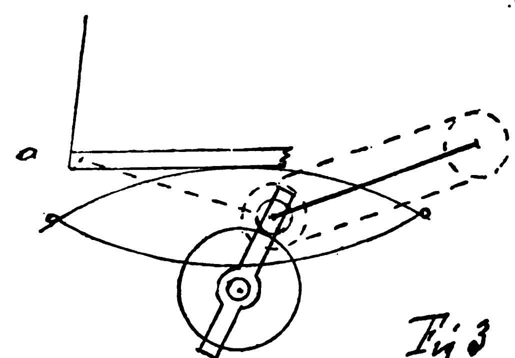



Fig 3

better because the weight is put nearer to the wheels and the axle can be lighter, and, like the carriage with four elliptical springs, the body has four points of support. A carriage, however, having the springs as shown in Fig. 1 has eight points of support, which will allow of lighter construction of the framework of the body, as well as doing away with the reach, as the distances between the points of support are considerably reduced.

When the elliptical springs are used as in Fig. 2, the movement of the axle is practically up and down, so that, unless there is a distance-maintaining rod between the driving shaft and the axle, there is a continual slackening and tightening of the chain and a constant liability of the chain being thrown off when going at fast speed over some obstruction or into some depression. Of course a distance rod should be used, but with elliptical springs and the reach there is considerable strain on the rod, unless the chain, instead of driving the axle differential direct, does so through the medium of a sprocket and a small gear on the bridge of the axle as in Fig. 3, this bridge or gear box oscillating freely and the chain being kept taut by the distance rod. I was surprised to find that a well-known make, on which this form of transmission is used, has the bridge connection run to the rear bar of the carriage body, as shown by the dotted line from a, instead of to the driving shaft, which must cause a considerable strain at times, besides the constant slackening and tightening of the chain on the road.

On the other hand it will be seen by reference to Fig. 1 that the movement of the rear axle in this construction is not straight up and down, but approximately in an arc whose center is the front or rigid support of the spring, and varying so little from that of a driving shaft placed as shown that the distance rod can be discarded. If a distance rod is used, the rear springs should be suspended movably at both ends, unless the transmission, as shown in Fig. 3, is used.

Mr. Heldt refers to the well-known necessity for suspending the motor, etc., on springs, yet a Western concern has put gasoline vehicles on the market that have the motors and transmission gearing placed directly on the reach or framework carried by the axles, the carriage body on springs carrying only the water tanks, gasoline tank, battery, etc.

H. W. S.

## A Helping Hand.

New York, April 30.

Editor Horseless Age:

Why does not some electric expert reader of The Horseless Age relieve that guileless soul, E. N. B., and tell him how to get five or six volts out of his storage battery? I am not an expert, and therefore, with some diffidence, advise him to put on another cell. What changes this would necessitate in his charging battery some other kind reader must tell him.

E. N. B. is not frank enough, and, judging by the communication from W. S. Howard, he draws on his imagination. Now he did not tell us that he used a substituted motor in the shape of a gray horse to pull the carriage when the wheel was lost, nor that this ideal speed apparatus of his would work on a level, so what are we to guess when he states that the cells run down to two volts from four when full-charged and when he says that he uses gasoline as low as 59? I suppose the latter is what is left after drawing the vapor off the original contents of his tank.

H. W. S.

[Possibly E. N. B.'s 1 volt per cell was due to his connecting the voltmeter across the battery terminal while the spark coil was still in circuit. It is not considered good practice to discharge storage cells below 1.85 volts per cell on open circuit.—Ed.]

## The Battery and the Packing.

Akron, O., April 30.

Editor Horseless Age:

I am out of all patience with the sloppy wet batteries, which cannot be kept tight, and would like to have some one put me on the track of a dry battery or a dynamo which is successful for the purpose. I use a touch spark which works very well.

Another point which has made me much trouble is to keep the cylinder head packed, as it will blow out. Do I use too much lead in the spark (it is about 3-16 in. and the engine seems to develop the best power at that point), or is it because I have not bolts enough in the head (cylinder 5 by 6 in. with six ½-in. bolts or cap screws)? I have used as packing asbestos, lead, copper, rubber, "Rainbow" and "Jenkins," and none of them will stay long.

Will some one give me a pointer, and oblige

ONE OF THE CRANKS.

# LESSONS of the ROAD

## A Steam Carriage Experience.

Editor Horseless Age:

I agree with the sentiment of your editorial of the 11th that users of horseless vehicles should give their experiences for the benefit of others; and possibly not purchasers only, but also builders may thus get an occasional idea, and "the cause" be promoted.

I cannot tell my story, however, without putting into it more or less comment and criticism, because my first venture with one of the new machines was a disappointment, and I must justify myself by saying how and why. Perhaps I ought to note at the outset that, though I am not a mechanic, my occupation and tastes are more or less linked to mechanical matters, and I have a good-sized machine shop and skillful men in it at my call. In this I am obviously more fortunate when it comes to repairing a motor than the average man. Also I must apologize beforehand for the freedom with which the first personal pronoun will probably be used.

I made up my mind before the end of 1898 that I must have a horseless carriage, and after a little investigation steam seemed to me the most reliable power to depend upon for extended touring over New England country roads—a conviction to which I still cling. So, early in 1899 I ordered a steam vehicle, and after several months it was delivered. It may just as well be added here that I sold it a few weeks later and began a search for one more to my mind, but using the same motive power. It was soon found, and when I get possession there may be another story to tell.

Now as to details. I had no printed "beginner's guide," only tuition for a couple of hours one afternoon by an expert sent from the factory. In the first half hour I learned that the fire would sometimes blow out in a moderate wind and have to be relighted with a match; also that the same wind sometimes made a back draft, which sent a dangerous-looking flame out from under the carriage and caused the gaping small boys on the curb to cry, "Mister, yer afire!" which was unpleasant. Subsequent experience showed the extinguishing of the fire to be a rather common thing, and it was of course an annoyance, especially if the wind blew out my matches as fast as I could light them.

During the initial trip I noticed a disagreeable noise from some portion of the machine, and as my instructor was about to leave me I asked an explanation. It was caused, I found, by the "buckling" of the copper walls or bottom of the water tank as the water oscillated within, and I was advised to do something "with a broomstick," just what I failed to hear, and I did not ask again. Afterward I found that the bottom of the tank had been severely punched in numerous places, apparently by the rounded end of a broom handle, driven by a mallet, with the idea, it is to be supposed, of stretching the copper into some shape which would not "buckle." That did not seem to me quite workmanlike, and I partly succeeded in accomplishing the same object with wooden wedges, applied outside the tank.

Returning alone from my instruction trip, I was offended as soon as the carriage was housed by a disagreeable smell of scorching material. Removing the bottom of the seat, I found the space under it and above the sheet iron "main flue" filled with hair felt, lying directly on the hot iron. It was blackened by the heat, and smoking as I pulled it out. The remedy was to put in some pieces of thick asbestos board before putting the felt back; and my comment was that there seemed to be some things left for the purchaser to finish up. This investigation led me to notice that the boiler and the engine cylinders were protected with hair felt, the boiler having asbestos paper first applied. Plenty of experience with just such covering on steam pipes assured me that with the high temperature due to 180 lbs. steam pressure the felt would soon begin to char and at no distant day would be reduced to powder.

My next trip was of 2 or 3 miles about the city, and two interesting things were observed: First, that I caught my overcoat twice on the lever controlling the throttle valve, and a kind Providence saved me from disaster; and, second, that I seemed to be getting uncommonly warm and moist about the legs. This latter phenomenon proved to be due to a smart leakage of steam at the throttle, the gland being found almost unscrewed. Only a loose curtain hung between my calves and the engine, and I should in time have found it uncomfortable under the lap robe. As I had already noticed leakages around the stems of two of the gasoline valves, I thereafter made it a rule to screw up every gland on the machine before starting out; and I seldom failed to find at least one loose. The throttle valve lever I provided with a simple catch, which prevented it from responding to an accidental jerk.

The third outing was also confined to the city streets. My nervousness being somewhat abated, I began to notice that the carriage was not comfortable to ride in over rough paving, unless the rate of speed was very slow; also that on smooth paving I must slow down to the speed of a walking horse when approaching even the best sort of cross-walk if I would avoid being bounced off the seat. This set me to wondering what would be the sensation on a rough country road. Having started with a full supply of fuel and water and run only about 4 miles (some of it pretty fast), I was startled on reaching home to find how much of both I had used, and at once set to work to make measuring gauges by which

I could tell the amount used on a trip by measuring before and after it. The gasoline tank held about 3 gals., and the water tank, when not too full, about 12. I had been told that this supply of fuel was good for from 75 to 100 miles, and the water for 40 miles.

Next trip out I went a little way into the country, on ordinary dirt roads, with some considerable hills. The whole distance was 12 miles, and I made two stops aggregating 15 minutes. Time, about 1½ hours; fuel and water, which had been in full supply at starting, were about half used. This was a surprise; but I was not unprepared to find that riding on a country road was much more like work than pleasure. Running over a stone of the size of a hen's egg lying in the road, for which one would not think of swerving an ordinary buggy, would give the occupants of the motor carriage a most disagreeable jolt; and a close watch of the road to avoid such obstacles was essential to comfort. As I had desired a vehicle for country travel, I was much disappointed to find that it was suited only to smooth roads, such as are not common in rural New England. The reduction of the radius of travel from a source of fuel supply was also a serious disappointment, as I could not believe that I had used steam extravagantly.

To learn what I could safely do in the way of stopping, without risk of frightening horses by the hiss of the steam from the safety valve, and without letting steam so low that a "torch" would be required to rekindle the fire, I experimented at home and found that the safety valve would blow (at 225 lbs.) in about 10 minutes after the fire was checked (at 170 lbs.) by the automatic regulators, and that if I turned off the fuel supply I could still relight the fire without the torch after 40 minutes. I also learned, on various occasions, that while the safety valve might be depended upon to "pop" at the predetermined pressure, it would not always close again until persuaded with a stick.

Having spoken of the torch used to start the fire, I will relate how I got acquainted with its construction. It seemed a very simple thing, and incapable of being injured, but I found it had "works" inside. Before I had fully realized the limitations of my fuel supply I got caught on the road with an empty tank. Being within the city limits, I used the nearest telephone and soon had a can of gasoline delivered to me; but not until the steam pressure had vanished. I then sought to heat my torch, and a coal fire in a kitchen stove some distance away from where the carriage stood was my only resource. Here I came to grief; the coal fire was a fiercer heat than I supposed, and my torch was red hot before I knew it; but I had no reason to think it damaged until I found I could get nothing through it. Dissection showed it had a "core" of very fine copper gauze, which had been melted at one point and so had sealed the tube beyond remedy. I gave up then; my companion went home on foot and I was dragged away in ignominy at the tail of an express wagon—drawn by a horse! Then I sent for a new torch.

This adventure was humiliating enough, but the next was worse, because I was wholly to blame for the happening, and unable to plead ignorance as an excuse. Being desirous of making ready to start in the shortest possible time, I called in the aid of an assistant, and between us we managed to light the fire under an empty boiler. The blunder was discovered within one minute, but enough damage had been done so that under pressure there was some leakage. To send the boiler to the makers was the only course. This involved taking down pretty much the whole of the piping, and experts were called in for the purpose. But restoring things to their original condition was more of a problem than taking apart, for it developed that in the original assembling about every piece of pipe used had been sprung into place or else arbitrarily bent until it met its mate. It also appeared later that after a joint was made tight it would not necessarily remain so, because boiler, engine and gasoline tank were independently supported by wooden girts across the bottom of the wagon box, and the piping connecting them must always be subject to the danger of straining. However, everything was at last in place, and in condition even better than when new, for neither trouble nor expense was spared to make the work perfect, and there was less forcing together of parts and more fitting; and it was a satisfaction to know that I had two men to call upon who now thoroughly understood the whole mechanism, or at any rate that part of it most likely to give trouble.

As an illustration of the possibility of leakage due to straining of a joint once perfectly tight, I may say that I found on one occasion a leakage of gasoline at a joint near the boiler (not a valve stem), and what was worse, the fluid was burning, though how ignited I know not.

After the foregoing experience I believe I had one or two excursions entirely free from unexpected happenings. But the next breakdown was not long postponed. At the foot of a long hill I noticed a shortage of water in the boiler which could only be due to a failure of the feed pump. Investigation showed that the short arm of the pump lever was broken; also that it was not well designed, being weakest where it should have been strongest. Fortunately, I was on this occasion within reach of city conveniences, and a halt at the first stable was in order, where, after letting pressure down, I could fill the boiler with a garden hose, heat my torch over a gas burner, and after getting up steam stand a fair chance of getting home. Of course, if on a country trip I might have filled the boiler by waiting for the steam to condense until the vacuum drew water from the tank through the disabled pump; and then I might have found some way to make a fire and heat the torch; but I didn't have to.

The substitution of the new pump lever for the broken one was an interesting piece of work, as further indicating the shop methods of the builders. Comparison showed that the broken lever had been bent both horizontally and vertically and then twisted more or less; and the same course had to be pursued with the new one before it would operate freely.

These varied experiences led me to wonder if I had not plucked an unripe fruit, so to say, which time might have improved; and it seemed to me that the ideal steam-driven pleasure carriage for touring, not racing, would be different from this one in many respects. For example, it would be decidedly stronger and heavier, with rather larger wheels and tires; it would carry somewhat more water and two or three times as much fuel; it would have boiler and engine bolted to one frame, and that frame secured to the running gear and not to the wooden wagon box; it would be designed so a fire could be started without a torch which must itself first be heated; and also so that the water tank could be filled by the wayside without the slow lifting of one bucketful after another by the sweating tourist; it would have some ready means of filling the boiler if the feed pump failed; it would have the engine and compound gearing, with their numerous oil holes and friction surfaces, encased from dirt; it would have means of adjusting the cut-off so as to use

steam expansively on occasion, and so economize fuel and water; there would be try cocks to use if the water glass were broken; the boiler and the engine cylinders would be covered with plastic magnesia instead of felt; the hot gases from the furnace would be discharged so that the tourist would not be liable to be enveloped in them when traveling with the wind; cylinder oiling and pumping up pressure on the fuel tank would be made easier; the brake would be stronger, and its pedal better located and provided with a lock so it could be left set; and there would be numerous little attachments furnished—bell, lamps, odometer, special tools and spare water glasses and their packing rings, etc.; glands at all valves would be secured against jarring loose, as would all nuts and important screws; and, of course, the ideal piece of mechanism would embody at all points the very best workmanship which could be put into it.

At this stage of my meditations I made up my mind to sell out and go hunting after perfection. One brief advertisement in The Horseless Age brought me 25 replies, and No. 1 paid my price and took the carriage, to the disappointment of most of the 24. Applicants hailed from Maine on the East to California on the West, and from Wisconsin to Texas. My customer lived in Maryland; and he got a machine which was, on the whole, in better condition than when I bought it, and he has not complained.

I am looking forward to more travel with fewer adventures during the coming season; but hope that the above plain narrative of my experience to date may be of use to some intending purchaser of a

STEAM CARRIAGE.

April, 1900.

## OUR FOREIGN EXCHANGES.

### Storage Battery Problems.

By E. J. Wade.

*(Concluded).*

Consequent in its turn upon the variations in the e.m.f., the relative rates at which the molecules generate current are correspondingly affected throughout the active materials, for only by that means can a uniform potential difference be maintained between every portion of the opposing electrodes. In this way, too, the inequalities in the strength of the electrolyte are prevented from passing certain limits, because just as fast as the acid in solution diminishes so does the rate of sulphation which brings about this diminution decrease also, until at all points in the active material the absorption of acid and its replenishment by diffusion just balance each other, the net result being that the outer layers supply considerably more and the inner layers considerably less than their due share of the current.

This unequal distribution of the work is not only maintained throughout the discharge, but becomes more pronounced toward the end, for the conditions which regulate the rate of diffusion are steadily growing worse the whole time. The active materials gradually increase in bulk as they sulphate, thereby reducing their porosity, and it is just those portions through which the whole of the diffusion to the interior has to take place that choke up soonest and most thoroughly.

As the discharge proceeds, the e.m.f. falls fastest when the sulphation is most rapid, and a more equitable proportion of the work would then be thrown on to the other parts of the active materials were it not that their output is limited by the rate of diffusion, so they can only draw on the surrounding electrolyte till its strength and their e.m.f. is correspondingly reduced. Thus the potential difference between all parts of the opposing electrodes falls gradually and uniformly, and the variations of acid strength, small at first, slowly increase, until by the time the e.m.f. of the outermost layers working in the strongest acid has dropped to about 1.85 volts, solely by reason of their advanced stage of discharge, the specific gravity of the solution round the inner layers will be 1.030 or thereabouts, and their e.m.f. also only about 1.85 volts, although they may not have done a tithe of the work of which they are capable.

At this stage the specific conductivity of the active materials becomes the chief factor in controlling the further course of the discharge. The resistance of the outer and most sulphated layers goes up rapidly, and for a short time the burden of the discharge is probably taken up by the layers immediately beneath them. These, however, soon follow suit, and the resistance of the inner layers of the electrolyte from which by now almost the whole of the acid has been abstracted, also being very high, the potential difference between the electrodes very quickly drops below the normal limit.

It is now apparent why the output of a cell decreases so much on heavy discharges, and also why little or no increase of capacity can be obtained by using masses of active material of more than a certain thickness. The higher the rate of discharge or the more impeded the diffusion, the less is the interior of the active material drawn upon for the maintenance of the current, while if either of these conditions is pushed to an extreme, nearly the whole of the work is done by a very thin outside layer, and by the time this is exhausted hardly any acid will be left in the electrolyte surrounding the remainder. Of course, as soon as the discharge is stopped fresh acid begins to diffuse in, and after a little while a further discharge is obtainable. By repeating this proceeding a sufficient number of times, the larger proportion of the deficiency on the first discharge may be made up.

Recharging is seldom effected at such extremely high rates as are sometimes used for the discharge, but they must often be quite sufficient to liberate acid in the pores of the active material considerably faster than it can be dissipated, and, although in this case the effects of imperfect diffusion are not so evident and the details of the procedure which brings them about are still more complicated, yet, following the same line of reasoning as has just been applied to the discharge, certain general conclusions may be drawn.

The outer layers of active material will absorb more than their due proportion of the current, and by the time they are fully desulphated the inner layers, as yet only partially charged, will be surrounded by abnormally strong acid to enable them to maintain an equivalent voltage. Unless, therefore, the current is prolonged for a time after gassing has commenced and the end of the recharge only determined by a sufficiently high potential difference being attained, there is some likelihood of the inner layers not receiving their proper charge at all, and in any event the gassing, by expelling some of the electrolyte from the pores and destroying its continuity, must itself greatly retard the process.

Not only, then, is the output of a cell materially diminished through insufficient diffusion, but its durability and life must also be more or less seriously affected owing to

the injurious conditions to which portions of the active materials and their metallic supports are thereby subjected: conditions favorable to the breaking up of the molecular structure of the former with "sulphating" and all its attendant evils, and to the destruction of the latter by local action. These effects are chiefly experienced by the innermost layers of active material which work in abnormally weak acid toward the end of the charge, and, in addition, do not undergo that thorough desulphation on charging necessary to help to bring them back to their normal state. The outermost layers also suffer, however, inasmuch as they are liable to be over-discharged to the point of reversal every time the full output is required from the cell. At the positive electrodes, wherever the layer of peroxide in immediate contact with the support is broken up from any of the preceding causes, the metal itself will become exposed to electrolytic action and its sulphation and corrosion greatly facilitated.

A third effect of imperfect diffusion is to reduce the electrical efficiency of the cell. In part it acts by lowering the average e.m.f. of discharge and raising that of recharge, the missing electrical energy appearing as heat generated at the end of both processes, when the outside electrolyte diffuses in and mixes with that of unequal strength contained in the pores of the active materials. But when this takes place, the conditions of equilibrium previously existing as regards e.m.f. between all parts of the active material are disturbed; local currents flow, more heat results, and consequently the ampere-hours available on discharge are also somewhat diminished, and those necessary for recharge somewhat increased. It follows, and is indeed found to be so in practice, that the best efficiency of a cell is obtained by commencing its discharge immediately the recharge is finished, and vice versâ. When the discharge rates are high or the diffusion poor, the difference may be considerable.

Undoubtedly the abnormal sulphation is the most serious result of impeded diffusion, for not only does it directly depreciate the electrodes and bring about a permanent reduction of their capacity in proportion to the quantity of active material affected, but also, by choking up the space available for the electrolyte, it aggravates the causes through which it was itself started, and so increases the temporary losses of capacity due to high discharge rates, besides reacting unfavorably on the cell's efficiency.

The only practical method of determining the extent to which diffusion into the pores of the active materials is provided for in a cell is to compare its outputs at different discharge rates. There have been cells on the market of the Faure type, and possibly are still, which show a steadily increasing capacity down to a 30 or 40 hour rate. Such inadequate diffusion is due either to the masses and layers of active material being too thick, or to the free access of the electrolyte to their surfaces being too much impeded, or to their porosity being insufficient; often it is brought about by a combination of these causes. The two former conditions can easily be improved by proper mechanical design. To compensate for the latter special devices are sometimes employed, such as perforating the active materials, or providing channels through their interior or inclosed spaces in their midst to act as reservoirs of electrolyte; but the more usual plan has been to mix various substances, such as magnesium sulphate, salt, sugar, carbon and so forth, with the lead compound used for pasting, and to remove them afterward by solution or the action of the forming current.

Still, when all these precautions are taken they will not increase the diffusion beyond a certain degree. That this is so is shown by those commercial cells of Planté type, in which extremely thin layers of active material are employed with a very free access of electrolyte to their surfaces, for even these do not attain their maximum output at more than a 12-hour discharge rate, although there is very little diminution at about a 9-hour rate, but above this it falls off with increasing rapidity.

The fact is, to go to the root of the trouble, the *molecular porosity* of the active materials, whether of the Faure or Planté type, needs to be considerably increased. If an ordinary active material prepared from a paste of litharge or red lead could be enormously magnified, it would be seen that the minute spaces between the individual grains are very caverns in comparison with those that penetrate the grains themselves, and it is these latter which appear to prevent the diffusion from proceeding at more than a certain rate, no matter how large the former may be. The total porosity of an active material is in itself therefore but a very partial guide as to its capabilities. For instance, its molecular pores might be almost stopped up with irreducible sulphate resulting from improper treatment during its first formation or afterward, and yet it could possess a very open structure as judged by a miscroscopic examination or by the quantity of liquid it was capable of absorbing.

Devices such as those just now mentioned may, within limits, improve the total porosity of the active materials, but they leave their molecular porosity unaltered, for this depends almost entirely on the lead compound used as raw material, and is rigidly fixed by its chemical composition and specific gravity. The only exception is in the case I have already referred to, where the partial sulphation of dense materials, such as Pb, PbO, or $Pb_3O_4$, at an intermediate stage of their first formation leads to growth and expansion and a consequent increase in their ultimate porosity.

The molecular porosity of active materials of the Planté type, and of all those of the Faure type prepared from litharge or minium, is probably only about 25 per cent., and can hardly exceed 40 per cent., even assuming that a very heavy preliminary sulphation takes place. A more porous material is obtained by the electrolytic reduction of lead chloride which has had a small proportion of zinc chloride fused with it. The two form a molecular compound that sets to a crystalline mass of low specific gravity, and when the zinc chloride and the chlorine of the lead chloride have been removed, every molecule of the lead remaining is surrounded by a space of about twice its own size. It possesses therefore a true molecular porosity of 65 to 70 per cent., and is capable of holding about two-thirds of its own apparent volume or twice its actual volume of electrolyte.

This active material perfectly fulfills the proper conditions as regards the quality of its structure, but as regards the degree of porosity it is only a step in the right direction. *In the ideal active material every one of its molecules should be surrounded by space sufficient to hold enough electrolyte for its complete discharge, so that no diffusion has to take place either from outside or between different parts of the active material itself.* To achieve this result it must be able to contain not merely twice, but 10 to 20 times its actual bulk of electrolyte, corresponding to a molecular porosity of 90 to 95 per cent.

It is, of course, one thing to indicate the ideal conditions, and quite another to show how they are to be attained. The problem is to prepare an active material possessed of an

extremely high molecular porosity without too much reducing its cohesion and mechanical strength generally. There are, at any rate, no fundamental difficulties in the way. Many substances exist, such, for example, as carbon in the form of charcoal, which prove that porosity and strength can go together. A remarkable instance is furnished by "block magnesia," a basic magnesic carbonate which has a 90 to 95 per cent. porosity and can take up about 19-20ths of its own nominal volume of liquid, and yet will withstand a crushing strain of more than 80 lbs. per square inch.

Given an active material with similar qualities, practically the full theoretical output corresponding to a 50 per cent. sulphation could, I believe, always be obtained from a cell, no matter how high the rate at which it was discharged. But what is of still more importance, the durability of the cell should be immensely increased and its life proportionately lengthened, and most of the causes that give rise to abnormal sulphation being eliminated there would be little permanent loss of capacity or electrical depreciation. Then, too, an exceedingly high electrical efficiency should be realized, for the dissipation of energy in the form of heat would be reduced to an almost neglible quantity.

If all these improvements are possible, there is yet hope that lead cells may eventually fill their unique position as the sole practical means of storing electrical energy far more adequately than they have hitherto done; but whether or no this comes about, I feel assured that no substantial advance remains to be effected except in the direction I have indicated, and the only other alternative will be to discover a new combination altogether.—The Mechanical Engineer.

## The Créanche Electrical Voiturette.

A French concern, the Société des Voitures Créanche (Ch. Bruel & Co.), 7 Rue Brunel, Paris, is making a light two-seated voiturette in which the motive power is electricity, and of which a general view is given in Fig. 1. The electric motor M (Fig. 2) is of the B. G. S. type, and of 4 h.p.; it is suspended from the frame, and is geared direct to the intermediary differential shaft R, from which the power is transmitted to the rear wheels by the usual set of sprocket wheels and driving chains. The electrical energy is provided by a battery of 44 B. G. S. cells, A, arranged in two groups, one consisting of three boxes, being located in front and one of four boxes at the rear. The boxes are arranged to slide in grooves formed in the bottom of the receptacles, so that they may be readily drawn out for inspection purposes; the cells are, however, arranged to be charged in situ. At a 15-ampere discharge rate the capacity of the battery is, according to the makers, sufficient for a run of 3 hours and 55 minutes, the average consumption of current being given as 10 amperes at 90 volts. The controller switch is manœuvred by means of a small hand wheel C at the side of the driver; it is arranged to give a variety of forward speeds, two backward motions, and an electrical brake. The average speed ranges from 20 to 25 kilometers per hour. The frame of the car, which is built up of steel and wood, is rectangular in shape and is suspended on the axles by plate springs. The wheels are of the cycle type, 25½ in. in diameter at the front, and 29½ in. at the rear; they are fitted with pneumatic tires, while the steering

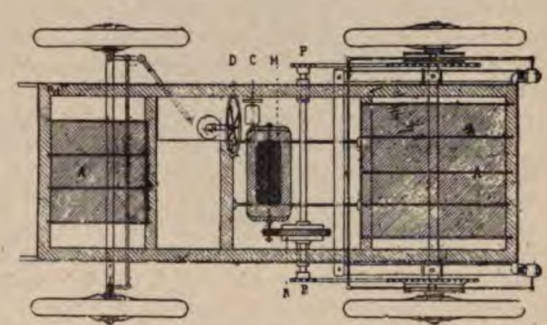


FIG. 2.

is controlled by a sloping hand wheel D. Ample brake power is available, for in addition to the electrical brakes above referred to, cord brakes acting on drums on the hubs of the rear wheels are provided. One of the Créanche vehicles took part in the recent Criterium des Electriques competition, the car being driven by M. Créanche, the manager of the company. Its weight complete was given as 670 kilogrammes, or a little over 13 cwt., while in the trials a distance of 86 kilometers was run on one charge of the batteries. The car is about 6½ ft. long, while the width between the wheels is 3 ft. 7 in.—Industries and Iron.


FIG. 1.

## Double Ignition and Speed.

The Paris correspondent of the Motor Car Journal writes our contemporary as follows:

"During a capital run that I had with the Hon. C. S. Rolls on his 12 h.p. Panhard from Paris to Havre last Saturday week not the least interesting feature of the drive was the effect produced upon the speed of the car by the employment of electric in combination with tube ignition. Immediately the switch was put over, the pace of the car increased very considerably, only to diminish instantly that the current was cut off. We had no opportunity of actually noting the difference in time over a kilometer, but I fancy that, comparatively speaking, it must have been very considerable. That the car was not absolutely dawdling along may be judged from the fact that on the level we timed her over many kilometers to be going from 53 to 56 seconds for the kilometer."

## A Forecast on the Race.

A French expert, writing in the Motor-Car World, is of the opinion that the 16-h.p. Panhard cars will probably defeat the German, English and American machines of much higher power. He points out that speed is not a question of power merely—as witness the late phenomenal records of Béconnais, Baras and others, on tricycles, none of which carried over 4 h.p.—but of power in proportion to weight. He says:

"Nearly all manufacturers, instead of giving attention to this point, have very largely increased the weight of their cars; indeed, the weight has very often been increased proportionately to the horse-power added. Two firms, however, who have had a vast experience in races (Panhard-Levassor and Mors) have very well understood this matter, and both, but especially Panhard, have worked so as to bring down the weight to the minimum. The motors built by these two firms are much lighter than those of similar types built in England and Germany. The bodies of the cars are, so to speak, suppressed entirely, and the driver sits on the oil tank, surrounded by a sort of aluminum gallery. As for the second person who has to be carried, he also sits on the floor of the car, and his legs are hanging in a sort of cul-de-sac. The wheels are very much reduced in weight; the spokes are about half as thick as those formerly used, and the tires are 90 mm. (3.6 in.) instead of 120 mm. (4.8 in.). The axles also are brought down to the minimum, the levers are shortened and lightened, the brakes on the wheels and the bronze pulley have been abolished, leaving only one brake on the differential gear, and all the rivets in the car have been made hollow, so as to diminish the weight. The result of all this has been to enable a 16-h.p. Panhard car to travel at an average of over 70 kilometers an hour in the Pau race, which means that it is able to travel at 53 miles an hour on the level."

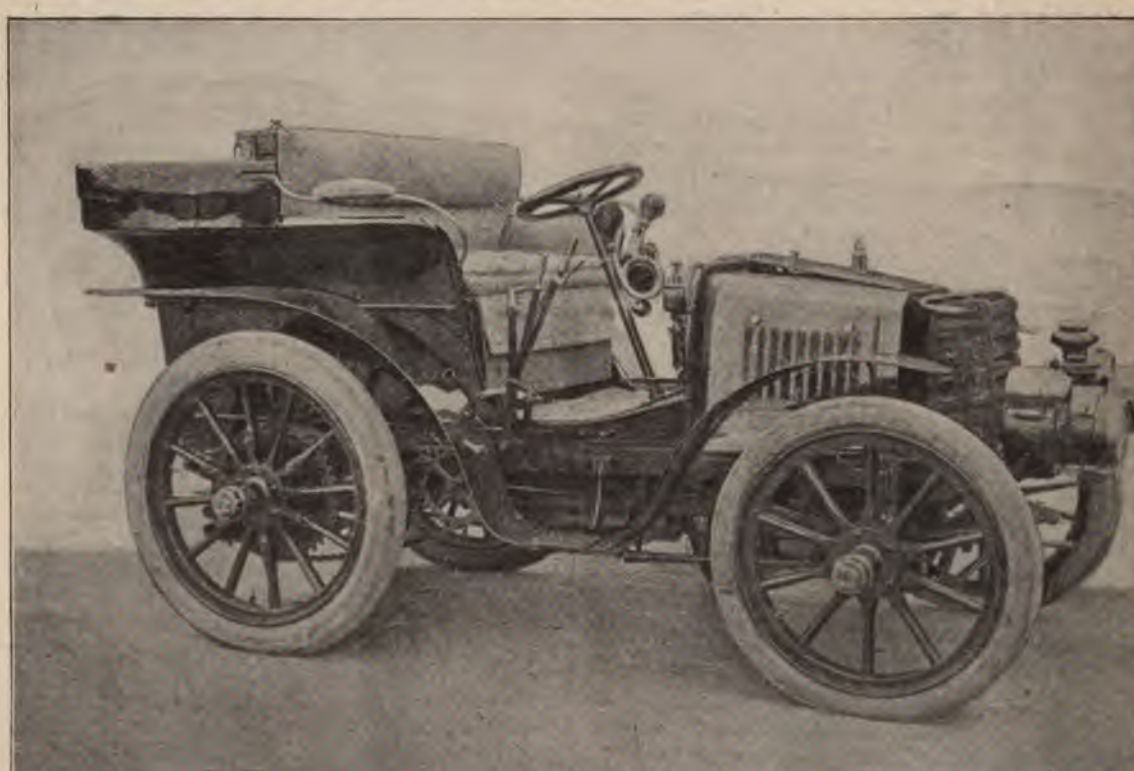
We show photographs of the new model of the 12-h.p. Panhard racing carriage, and of the 1900 standard Daimler frame, for which we are indebted to the Motor-Car World and the Motor-Car Journal respectively.

## A Handbook on the Gas Engine.

The great lack of practical information on the gas engine, of such a sort as to be useful to the draftsman and not merely to the student, has often been commented on, but until very recently it has been a fact that the men who were willing to impart information about gas engines to the public have not been the men who knew from actual experience how gas engines ought to be built. As a result, the texts on the subject have confined themselves to historical treatment and to a discussion of the thermodynamic principles in the abstract—a work excellent in its way, but affording no more than a groundwork for the designer, and to the beginner often utterly misleading in its inferences. The want has been supplied in England by the publication of the books of Grover and Norris, but it is not too much to say that no book on American practice of any value has appeared until the publication of the little volume that lies before us.*

In this book the author has avowedly undertaken to fill the gap by a brief outline of principles, followed by a review of

*The Gas Engine Handbook, by E. W. Roberts, M. E. The Gas Engine Publishing Co., Cincinnati, O. $1.00 and $1 25.



1900 MODEL, 12 H. P. PANHARD CAR.

valve and igniting mechanisms and a series of chapters giving rules for calculating the size of cylinder for a given power, and formulæ for proportioning the parts. All the chapters are short, and no attempt at elaborate mathematical analysis is made. Among the special topics are: Care of an Engine; Gas Engine Troubles; Handling a Gasoline Engine; Governors; Foundations, and General Rules for Selecting an Engine. Motor carriage engines receive a brief, and, it must be admitted, rather perfunctory notice; and the subject of vibration is dismissed with a mention of the cylinder arrangements most used and a formula for calculating the balance weights of a single-cylinder engine. This is probably necessary in so brief a treatise as is here intended, but the same can hardly be true of the extremely meager space allotted to carbureters and vaporizers. The chapters on the valves and working parts are good, and the subject of testing is handled in a practical way. Occasional typographical errors are noticeable, and on page 132 the formula $d^2 = \frac{D^2 p}{s\,n}$ should be printed $z^2 = \frac{D^2 p}{S\,n}$.

## A Water-Cooled Aster Motor.

We illustrate a new size of the Aster motor, of 3 h.p., with water cooling. It is being introduced into this country by the Waltham Mfg. Co., who are agents for the "Aster" line.



1900 MODEL, DAIMLER FRAME.

## A Portable House for Motor Carriages.

A novelty which cannot fail to interest owners of motor carriages is a portable "house" for automobiles, made of finished white pine in sections which can be put together wholly with bolts and screws. Each section is 3 ft. 2 in. wide and of various lengths, and a house can be enlarged or reduced by simply adding or removing sections. A good coat of paint is applied to the exterior, and the walls and roof can be made double if desired for greater warmth in winter and coolness in summer. Each house has a good pine floor and a small window over the door in front. Windows can be put in the sides if wanted. By reason of its light weight and portability the house can be taken to the seaside or the mountains in the summer, if desired, or moved to a new residence without trouble.

The Du Bois' Automobile Agency, 220 Broadway, New York, are the makers of this house, and they supply the following standard sizes: No. 1, 6 ft. 4 in. x 9 ft. 6 in., with side panels 6½ ft. high to eaves of roof; No. 2, 9½ ft. x 9½ ft., same height; No. 3, 9½ ft. x 9½ ft., with side panels 7½ ft. high. The photograph shows the No. 3 size of house.

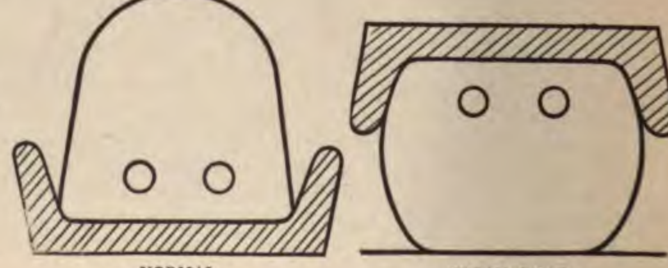
## Notes from Newark.

The flanged or air-cooled type of cylinder for small gasoline motors is engaging the attention of a number of founders in Newark. The Smith Motor Co. has placed an order with Arthur Barlow for castings of this description, and the New Jersey Machine Works are also producing them successfully. That it is not the easiest thing in the world is shown by the fact that two other foundries, one of which has for some time been announcing itself as prepared to take orders for these castings, recently admitted to a representative of The Horseless Age that they had not got beyond the experimental stage with them.

Phineas Jones & Co. report orders from twenty makers of motor vehicles for their wood wheels, and the Smith Motor Co. is getting orders from Western builders for motors. The Messerer Automobile Co. announce that their vehicles will soon be on the market.

## A Rubber Tire.

A leaflet received from the Revere Rubber Co., 59 Reade St., New York, illustrates the method of applying their solid rubber carriage tires. These tires are made under the Langmuir patent and are of the section shown in the cut. They are bound with wire, and the method of applying them to the steel channel rim is to thread the wires through the tire and splice them with a twisted joint; the wire is made a little short in length, and the tire is stretched over the steel channel by the aid of special tools. In this manner the tire is bound on the rim with the utmost tightness.



NORMAL. UNDER LOAD.

## MINOR MENTION.

The Cosmopolitan Power Co., of Chicago, has been incorporated under the laws of New Jersey, with a capital of $40,000,000.

The Felker Cycle Co., Denver, has taken the Colorado agency for the Locomobile, and has just received a carload of eleven machines.

The Boston Board of Aldermen has passed an order requesting the Board of Park Commissioners to permit the use of private motor carriages throughout the park system.

Through an error in our last issue, the item stating that the Smith Motor Co. of Newark had given the N. J. Machine Co. an order for one hundred sets of castings, should have read one hundred motors, not castings.

The Berlin Iron Bridge Co., of East Berlin, Conn., have received the contract for 13 important bridges on the N. Y., N. H. & H. R.R. Ten of these are heavy four-track bridges and three of them are to carry highways over the tracks. All the work is to be completed by Oct. 1.

Owners of motor carriages in Columbus, O., have formed a club. At the first meeting the proposed ordinances regulating the speed of vehicles were discussed with reference to the superior controllability of these vehicles over those drawn by horses, and a resolution was adopted favoring a speed limit of 12 miles per hour within the city limits.

One of the large lumber companies in Minnesota has been experimenting the past two years with a design for a sled that should propel itself and haul a load over the ice and snow roads of the forests, and it has this winter succeeded in making a sled that goes. It is a locomotive on runners, and the power of the entire engine is applied to two drums, one at each end of the sled.

The Boston Gear Works have sent us their catalogue of compensating or differential gears for motor vehicles. Several styles are shown, of different sizes for different powers, all of which are standard, and with the parts made interchangeable, and most of which are kept in stock. Some full-size sections are shown, drawn to scale; and the Boston sprocket chain is also listed and illustrated.

There has been some talk of a line of automobile stages from Delhi to Bloomville, N. Y. The proposition comes from President Coykendall, of the Ulster & Delaware R.R., and he agrees to put on all the carriages necessary to do the business if the road is widened and made suitable for the operation of such conveyances. The time from Delhi to Bloomville would be half an hour, and from there to New York five hours or a little more.

According to the United States Consul at Gothenburg, Sweden, many business men in that city think that an opening could be found for motor carriages in Sweden. Some cab owners there lately sent experts to Berlin to study the question of motor cabs. Apparently they found nothing but electric cabs, and their report on these was unfavorable, as they could not turn the corners sharply enough for the narrow streets of Sweden, and moreover were hopelessly stopped by an inch depth of sand.

Roland R. Conklin, of the North American Trust Co., New York, has planned an automobile trip with a 10-h.p. gasoline machine through France, Spain, Austria, Bavaria and England. The party will include, besides Mr. Conklin's family, the Rev. Minot J. Savage and a Frenchman to run the machine and act as interpreter. The party will leave May 17 on the North German Lloyd steamer Main.

We have received the catalogue of the Columbia Motor & Mfg. Co. It is handsomely gotten up, and contains descriptions and illustrations of their types B-1 and C-1 steam carriages, type D-1 coupé and type E-1 'bus. Regarding their motor, they say: "Engineers will be interested in the fact that the valve-controlling device of this engine will maintain a constant admission lead through the full range of cut-off from 5-16 to 7-8 stroke, and when cutting off at shortest point will not give excessive compression or premature exhaust." An important feature of their vehicles is the condenser, which makes it unnecessary to refill the water tank more than once a day.

## METROPOLITAN NOTES.

The Automobile Co. of America, of Marion, N. J., is using the Wood wheels made by Phineas Jones & Co., Newark.

Herrmann Boker & Co., 101 Duane St., New York, send us a circular describing their "Full Moon" and "Baldwin" acetylene gas bicycle lamps.

The Westchester Racing Association announces that a completely equipped automobile service, with broughams, hansoms and surreys, between New York and Morris Park, will be inaugurated on Saturday, the first day of the spring meeting. A charging station has been established at Morris Park.

The Boston Artificial Leather Co., West Eighteenth St., New York, are sending out samples to the trade of their "Moroccoline," large enough to make a test as to their durability for upholstering seats or cushions. This company is undoubtedly the pioneer in this industry, having been established since 1881. Over $150,000 was spent in experiment before Mr. Dole, the general manager, was convinced that they had the correct article. "Moroccoline" is made from woven fabric by coating it with a special waterproof preparation. It can therefore be made of any desired size in a single piece. It is embossed by the same process as real leather, and any of the leather "grains" can be produced in it.

### Practical Advertising.

The Seguine-Axford Veneer Co., of Jersey City, N. J., are building a motor vehicle for the purpose of advertising their moisture-proof wagon panels. The body of the vehicle will be made entirely of these panels, and the vehicle will be sent all over the country to give ocular demonstration to prospective purchasers.

This would seem a good opportunity for some enterprising concern to supply the motor, running gear, wheels and fittings and thereby advertise their products at small expense.

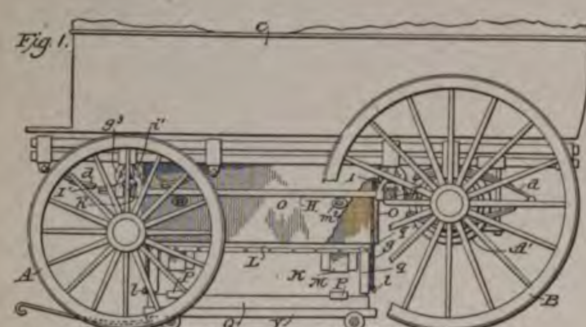
# MOTOR VEHICLE PATENTS

# of the world

## UNITED STATES PATENTS.

No. 647,475—Battery Handling Attachment for Motor Vehicles.—G. Herbert Condict, New York, N. Y., assignor to the Columbia & Electric Vehicle Co., Jersey City and Hartford, Conn. April 17, 1900. Application filed Dec. 16, 1898.

The main feature of this invention is an arrangement for raising a tray of storage batteries into the desired position for use upon a motor car or vehicle and also for lowering a discharged tray therefrom, said means comprising an apparatus, permanently connected with the vehicle, whereby the heavy trays of batteries may be handled by apparatus carried upon the vehicle, thereby rendering the same independent of any battery handling apparatus external to the vehicle.
process of repair.



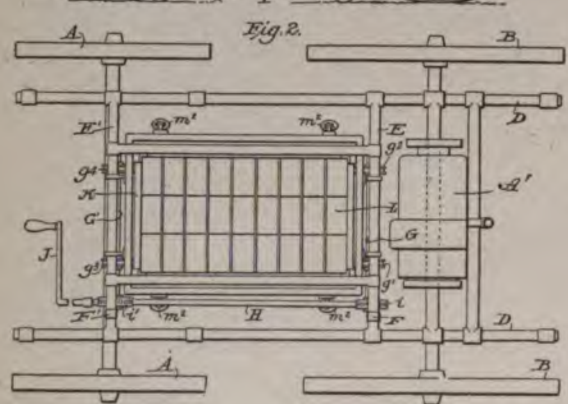
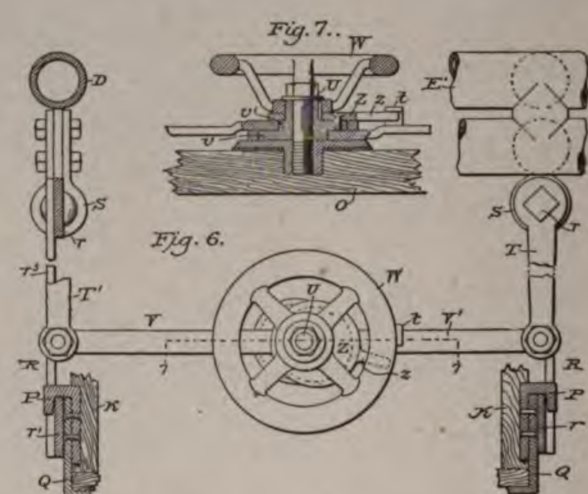




Fig. 1 is a side elevation of the running gear and part of the body of a motor vehicle to which the invention is applied. Fig. 2 is a top plan view of the running gear—Fig. 1—without the body. Fig. 6 is an enlarged detail view showing the means for opening and closing the battery tray supporting devices. These are located at the ends of the frame, and the hand wheel W (not shown in Figs. 1 and 2) is mounted on one end of the case or box O. Fig. 7 is a sectional view on the line 7 7, Fig. 6.

In Figs. 1 and 2, C is a portion of a body, supported upon a frame which has longitudinal bars, D D, and may be supported upon suitable springs, d d. To this frame are secured transverse bars, E E', and to these are secured the arms F F' depending therefrom on each side of the center of the vehicle. The arms are formed with bearings, f f', in which are journaled shafts, G G', and upon each of these shafts are winding drums, $g'$ $g^2$ $g^3$ $g^4$, each provided with cords or chains, g, having loops or hooks, h, at their lower ends.

A worm shaft, H, carrying worm pinions, h' $h^2$, one at each end, is mounted in bearings formed in yokes, I I', integral with the bearings f f'. At one end of each of the shafts G G' are secured worm gears, i i', which mesh with and are driven by the worm pinions h' $h^2$ upon the shaft H when the said shaft is turned, as by the crank J.

The tray K has hooks, l, secured to its ends, in position to connect with loops, h, attached to the cords g, whereby the winding drums upon the shafts G G' will wind up said cords simultaneously and lift the tray.




The tray K is usually a stout wooden box and is reinforced by an angle iron, Q, extending around its lower portion and under the bottom. Supporting hooks, P, are attached to this angle iron at the sides as shown, and are riveted to the angle iron Q. The tray is furthermore provided with four permanent contact plates, M, which are connected with the batteries L and inclined at a slight angle; and as the battery is forced upward into position they make contact with four correspondingly placed contact devices upon the vehicle, which are pressed into engagement by springs and are connected to the circuit.

The tray of batteries when in operative position is suspended from latch plates, R, having lower members, r', whose edges fit under the hooks P and support the tray.

In order to admit of the raising and lowering of the tray of batteries by the hoisting apparatus the latch plates are

thrown out of engagement with the hooks P and held out until required. To this end crank arms, T T', are attached, one to each of the front ends of the upper members r of the latch plates R. Upon the box O is secured a stud, U, upon which is rotatably mounted a double eccentric, v v', connected with hand wheel, W. Eccentric rods, V V', are pivoted to the outer ends of the crank arms T T' and formed with straps on their inner ends, which engage the eccentrics v v'. When the hand wheel W is turned the eccentrics will be rotated and the rods V V' will be drawn together, drawing the latch plates under the hooks P, as when a fresh tray of batteries has been hoisted into position, and, vice versa, when it is desired to remove a tray of exhausted batteries from the vehicle, the said tray having first been slightly raised by means of the hoisting apparatus to lift the edges of the hooks P above the edges of the lower members of the latch plates, the hand wheel W is turned in the direction to separate the latch plates, when they will be forced out by the eccentrics and connections from under the hooks P and be so held by the eccentrics, permitting the lowering of the tray and the insertion of a new one.

A cap plate, Z, placed over the upper eccentrics v', is provided with a lug, z, to abut against a stop, l, upon the eccentric rod.

Nineteen claims.

No. 647,505—Vehicle Frame.—H. P. Maxim and H. M. Pope, Hartford, Conn., assignors to the Columbia & Electric Vehicle Co., Jersey City. April 17, 1900. Application filed July 28, 1898.

Fig. 1.

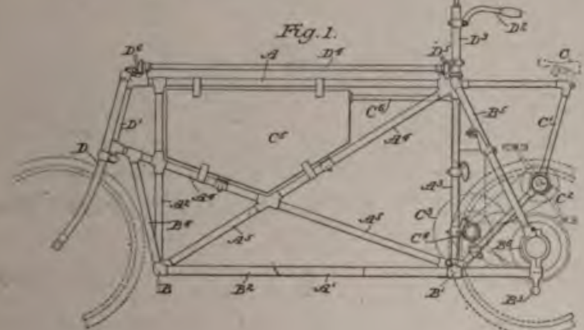
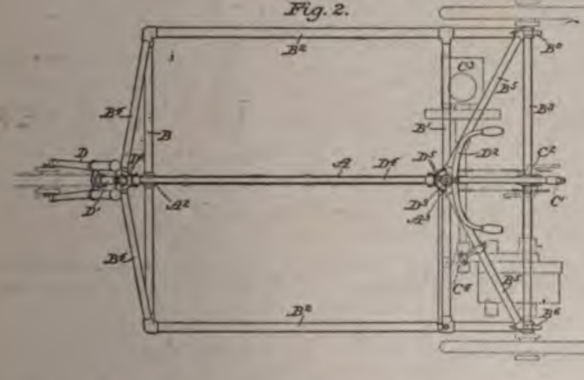


Fig. 2.



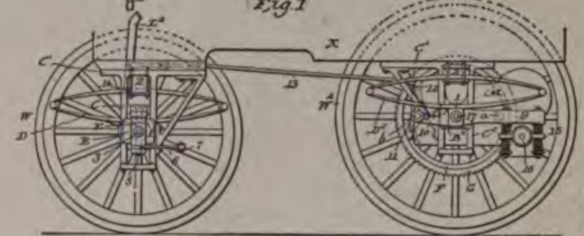
This is intended primarily as the frame for a delivery tricycle or quadricycle. A central girder is formed of the horizontal members A A', connected by the vertical members $A^2$ $A^3$ and stiffened by the braces $A^4$ $A^5$. Transverse members, B B', are connected at their outer ends by $B^2$ $B^3$ and form a frame to support the trays or boxes intended to be carried. The fixed weight of rider and motor is as nearly as possible over the rear wheels, and provision is made at $C^2$ for auxiliary pedaling if required. Steering is through the bevel gears $D^5$ $D^6$, and the gasoline tank is made thin and placed inside the frame at $C^6$, so as not to take up valuable room.

Seven claims.

No. 647,600—Running Gear for Automobiles.—Lucius T. Gibbs, New York, N. Y., assignor to Clarence W. Wood, same place. April 17, 1900. Application filed Dec. 11, 1899.

In this invention the reach is discarded, but instead of leaving the elliptical springs to endure the whole horizontal shock when the wheels strike an obstruction and the body surges forward by its momentum, the axles are supported at each end in boxes, which boxes are free to slide vertically in pedestal guides attached to the body. This arrangement is similar in principle to that of a railway truck, except that here the axles may be keyed to the boxes instead of turning. The

Fig. 1



general arrangement is clearly shown in Fig. 1. Here 1 1 are the axle boxes, sliding in the pedestal jaws C $C^1$ $C^2$, which are braced as shown. The front wheels are carried on the usual short steering axles outside the boxes. The rear axle, in the figure shown, is solid and the rear wheels revolve independently on it, each being driven by its own motor, M. The rear axle boxes carry arms, 9 10, of which the latter affords a support and fulcrum for the brake levers 11 12, which apply an internal brake ring, F, inside the dished gear G. The motors are pivoted on the axle and suported by the arms 9 through the springs 15, and they drive the gears G (keyed to the rear wheels) through the pinions 16.

When a single motor is used it may be supported about midway of the rear axle, which is then split and provided with a differential.

Nine claims.

No. 647,651—Gas Engine.—Wm. R. Dow, Boulder Creek, Cal. April 17, 1900. Application filed July 30, 1898.

This invention is an attempt to utilize the waste heat of the jacket and exhaust to raise steam. The water from the jacket is passed through a boiler, which is heated by the exhaust gases, and the steam thus generated is utilized in a cylinder placed in tandem below the explosion cylinder. The steam cylinder is jacketed with the waste gases from the boiler, and a compressor is added for the explosive mixture, in order that every revolution may have a working stroke.

No. 647,669—Steam Engine.—George Code, Boston, Mass. April 17, 1900. Application filed June 5, 1899.

An arrangement of several small single-acting cylinders radially about a single shaft, the connecting rods working on gears which mesh with a single gear on the central shaft.

## SPECIAL NOTICES.

**Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.**

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A thoroughly competent foreman, who has had experience in the manufacture of small gasoline or gas engines and who is familiar with modern, economical methods of manufacturing. Excellent opportunity for the right man.

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A Motor Carriage, steam or gasoline. Winton preferred. Must be in good order. State price and make. Address A. L. LOCKWOOD, No. 23 Park Street, Gardner, Mass.

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M. A. C., care of HORSELESS AGE.

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Automobile, electric or gasoline. Must be cheap. State make, how long used, etc.

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Immediate delivery. One electric runabout automobile, used very little. Equipped with new battery and newly painted. The first order received at $700 net takes it. Address MOTOR,

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Are you Building a Motor Carriage? If so, send $2.00 for detail and assembled drawings of complete Running Gears, with latest construction of steering, equalized axles, etc., with all dimensions and particulars.

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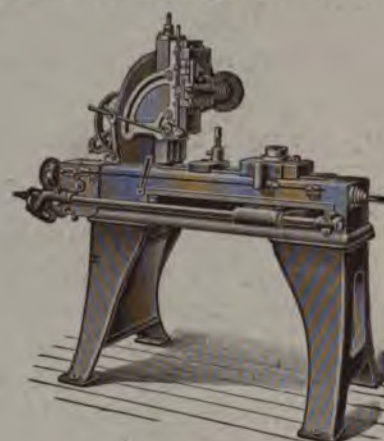

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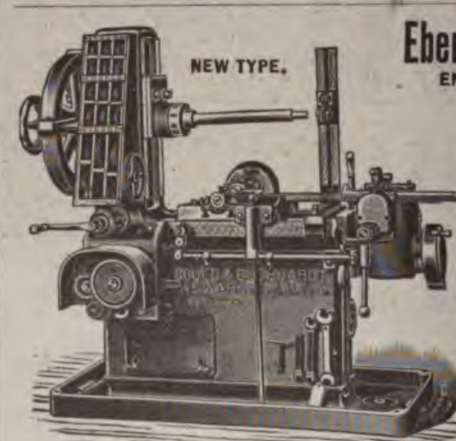


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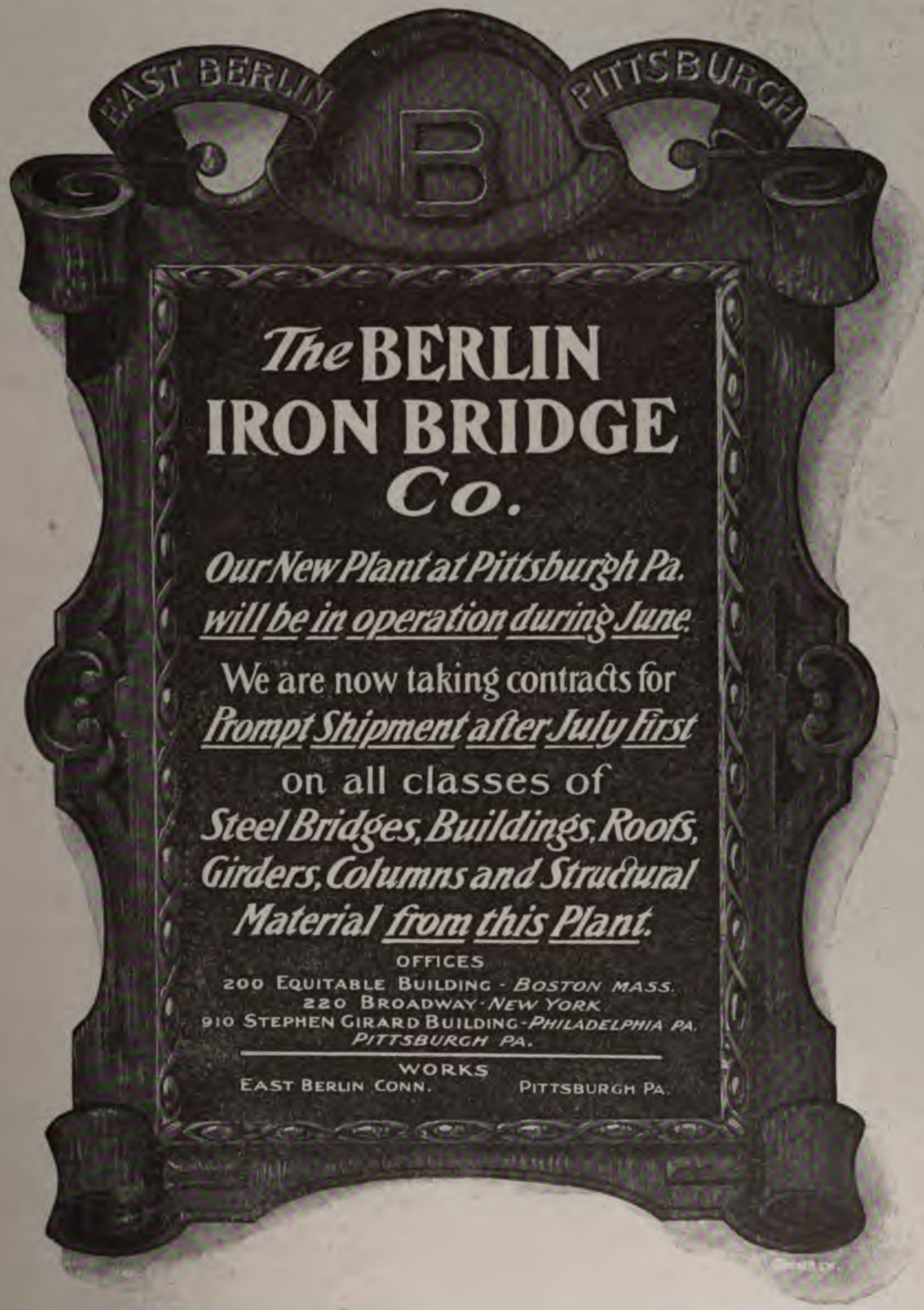
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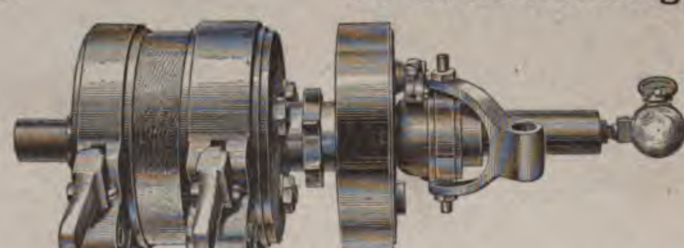

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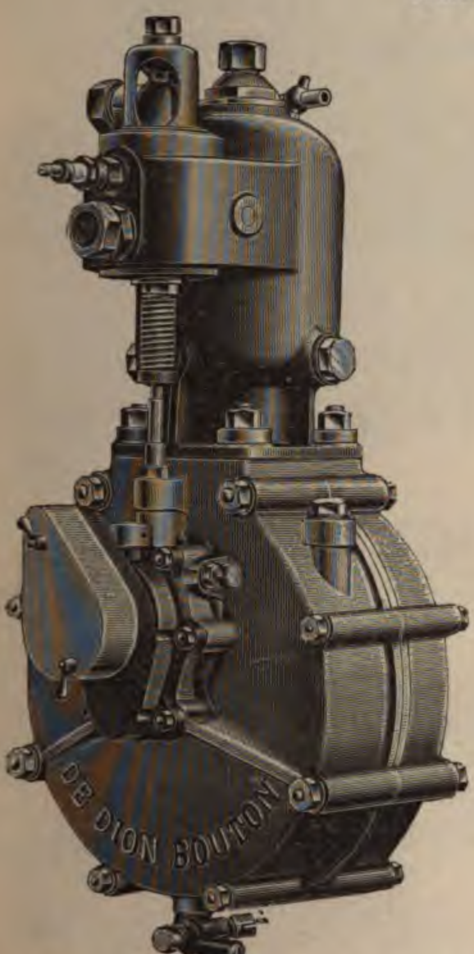


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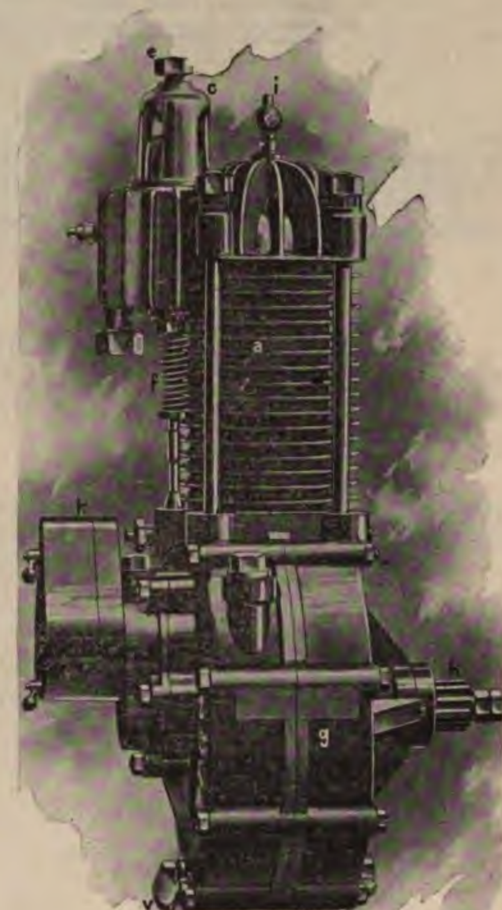

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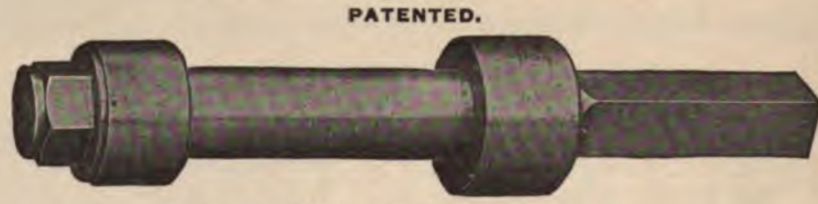

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VOL. VI. NEW YORK, MAY 16, 1900. No. 7.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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## Some Questions of Taste.

Observers of the motor vehicle's rise have taken frequent occasion to animadvert against what they—not inaptly—style the "horse wanted" appearance of many of these vehicles. They point to the dashboard, to the deceptive lightness of appearance, to the line-for-line copying of the forms long associated with equine traction; and they say that the term "horseless carriage" is quite ideally appropriate for a vehicle whose perpetrator has avoided any suggestion of an internal motive power as if to show it were somehow a breach of good taste, like revealing the mechanism of a stage illusion. Why call this thing a motor carriage, say they, when, so far from exhibiting a motor, it so obviously lacks a horse?

The criticism is one whose justice we have nowhere heard denied, and the offenders, when brought to book for their sins, are apt to shuffle weakly and say that they have been too much occupied with perfecting the motive power to think about appearances. Such an excuse, however, is palpably disingenuous, since the very concealment of the mechanism argues either that the latter is too hideous to bear the light or else that its makers are acting on some conscious theory. Some of them come out roundly and lay the whole blame on their customers. The public, say they, does not understand machinery and objects to its display, hence they make it as simple as they can, and then cover up the rest. If they did not, the possible purchaser would take fright before negotiations were begun.

This last assertion is certainly true in many cases, and the condition related has been no small factor, both in prompting adherence to horse-vehicle forms—for which nevertheless we doubt if any sufficient pretext could be invented—and also in leading builders throughout the country to simplify and to conceal the mechanism. The ultimate result of the latter will be beneficial, of course, since no normally constituted individual takes delight in complexity for its own sake; but meanwhile the fact as it exists invites certain reflections. The first of these is that the builders are largely responsible for the public attitude by which they profess to be governed. If the public thinks of the motor vehicle as a "press-the-button" affair, who but the manufacturers are to blame? And if the public is led or suffered to think this, what is more certain than that it will demand a press-the-button vehicle? And what will be more natural than the same public's disgust when it realizes that its new toy has not one but many buttons? Sooner or later the motor vehicle must be recognized and accepted for what it is, a highly developed piece of mechanism; and if that day comes sooner instead of later it will be so much the better for the industry.

We are glad to believe that in some quarters the dawn of that day is already visible, and in that belief we feel justified in pursuing the argument, and inquiring: Granted that the self-propelled vehicle should be distinct in appearance from the horse-drawn; and furthermore, that this distinction should take the form of an external intimation of its internal character, what shape should this intimation take?

As we think that most of the motor vehicle's future is still ahead of it, we do not propose to attempt rash prophecies.

The progress already made, however, indicates certain principles that may be accepted as safe. Professor Sweet said once that, "to the truly educated eye, whatever is right looks right," and we believe that the aphorism is the true key to the motor vehicle's design even as it is the key to all engineering design. Every attempt to design an automobile with reference to an arbitrary "æsthetic" standard, conceived in ignorance of its structure and use, we believe to be futile. Such a design has no intrinsic basis, since there might be as many "standards" as critics; and the pressure of real needs will soon force the imaginary ones aside. Did a high dashboard "look well" to the carriage builder who first used it? Most likely not, but it was necessary to intercept the mud from the horse's heels. If a high dashboard on a motor carriage "looks well" now to our biased vision, we may be sure that a low one, merely high enough to keep the wind from the rider's ankles, will look much better to our children. Does a high body still look well to us, with no longer a horse to look over? We may again be sure that it will look absurd when the need of a low center of gravity to offset the added weight and speed is once understood. Do wood wheels look heavy and clumsy? When we realize what work they have to perform with a heavy carriage, we shall be afraid to trust ourselves to the "spiderwebs." Is a water radiator unsightly? Possibly, until you know what it is for. Some time you will condemn the carriage that is without it.

It is common to arraign the French vehicles as being "hideously ugly," "machines all over," "too complicated for any use," etc. The multiplicity of their levers is a serious fault, and American makers are quite right in endeavoring to combine the various functions of control in fewer motions. They use a hand wheel for steering, which is not favored on this side; and they betray a frequent lack of that highest kind of ingenuity which is able to reduce a mechanical proposition to its simplest terms. But in general design they are splendidly adapted to their work; there is no "horse wanted" appearance about them; fitness for the work in hand is their sole test; and in refinement of design they probably surpass anything yet done elsewhere on either side of the Atlantic. They do not look as comfortable as our carriages; but they travel on better roads, and it is no imputation against a French voiture that it is not built to run on a Berks County wagon track.

The conditions in France have resulted in a demand for speed first of all. In this country, while reasonable speed is desired, reliability and comfort are held of equal or greater importance, and we are not likely to copy French models to the extent of sacrificing the latter qualities. But we can still learn much from them in the matter of harmonious design to a given end; and often, it must be admitted, there is much still to learn.



## The Primary Battery Fake Again.

We are informed that persons calling themselves G. Attwood and W. W. Wood, of this city, are, or have recently been, in Ottawa, Canada, for the purpose of selling stock in an alleged primary battery invention which they claim is destined to revolutionize the whole field of electric light and power. We know nothing about either Messrs. Attwood and Wood or their battery, and we have been unable to learn of any one else who does. We do know that the claims attributed to them by the Ottawa press are preposterous on their face, and so extravagant that it is difficult to see either how any man of ordinary common sense could be wheedled by them into parting with a single penny, or how any self-respecting paper could give them the sanction of its columns. One of the mildest of these is that by a combination of their batteries and storage cells, occupying a space of two cubic feet, an automobile could be run "from here to California without getting out of the carriage except for water to refill the jars," an operation which is averred to be necessary only once a week. We should be sorry to believe that any readers of The Horseless Age could be gulled by so childish an absurdity.

## The Way They Do It in Maine.

In The Horseless Age of April 18 we recorded the incorporation of the Eclipse Automobile Co., of Portland, Me., with a capital stock of $50,000, of which $70 was paid in. At that time we ventured the hope that there was a misprint in the source of our information, but the report of three other "companies" of the same stripe leads us to conclude that we were too hasty. Here are the names of the latter: The New Era Automobile Co., organized at Portland, Me., "for the purpose of manufacturing and dealing in automobiles, motor wagons, bicycles, etc.," with $300,000 capital stock, of which $175 is paid in. The officers are: President, H. L. Cram, of Portland; treasurer, William P. Burnell, of Boston, Mass. The Motorcycle Mfg. Co., organized at Portland for a similar purpose. Capital, $100,000, of which $15 is paid in. The officers are: President, C. L. Swan, of Stoughton, Mass.; treasurer, William T. Marsh, of Brockton, Mass. The Boston Automobile Co., organized at Eden with $100,000 capital, of which $300 is paid in. Officers: President, E. Thirley Goddard, of Eden; treasurer, Frank Pinkham, of Eden.

Frank Stutzman, of the firm of Elliot & Stutzman, Williamsport, Pa., has built a "railroad automobile" for use on the Eaglesmere Railroad. This is a narrow gauge line connecting Stonestown, the terminus of the Williamsport & North Branch Railroad, a feeder of the Reading system, with Eaglemere, a mountain lake resort frequented by Philadelphians during the summer season. The Eaglesmere Railroad is operated regularly only during the season, and the use of a gasoline motor is expected to save the costly operation of firing up on a locomotive for special trips during the winter. The first machine is a somewhat crude affair, mounted on a hand car running gear, but it is the intention later to construct a more perfect machine.

TESTING THE PACKARD GASOLINE CARRIAGE.

## The Packard Gasoline Carriage.

After a thorough course of preliminary experiments, the New York & Ohio Co., of Warren, O., who are well known as the makers of the "Packard" incandescent lamps and transformers, are bringing out a new gasoline vehicle embodying some features of exceptional interest.

The general appearance of the carriage is shown in the small half-tone. It is solidly built, to endure high speeds on rough roads, and the workmanship is thorough and first-class. The wheels are both 34 in. in diameter, with 3-in. pneumatic tires. This diameter of wheel was preferred to a smaller one, as it improves the running and steering qualities of the vehicle; and as front and rear wheels are alike, only one spare tire need be kept, and if desired the rear tires can be put on the front wheels when too far worn to be of further service for traction. The gauge is standard, 4 ft. 8½ in., so that the wheels will track on country dirt roads. The frame is of seamless steel tubing, made flexible by ball joints, so that any wheel can rise independently of the rest. Double elliptic springs support the body at the rear, and a reversed elliptic spring carries the front end.

The engine is of the horizontal, single cylinder, four-cycle type, with a high compression for full load and a throttling control. By an automatic device the lead of the ignition, which is of the jump spark type, is shifted to correspond to any speed at which the engine may be running. The engine is designed to run at a normal maximum of 800 revolutions, and at this speed, with a full charge, it will brake 9 h.p. All ordinary grades can be climbed with the ordinary gear. A spring transmission is interposed between the engine and the gear shaft, which prevents binding in the bearings and relieves the wheels of the "kick" of the explosion.

A gear and chain drive is used. The reverse is a slow speed, giving with varied speeds of the engine from 6 to 10 miles per hour. The hill-climbing gear is approximately the same speed. With this gear any hill can be climbed, and the worst cases of sandy or muddy roads can be negotiated. The high or working speed gives a range of from 7 to 20 miles or over per hour, dependent upon the speed of the engine. The machine can be geared as required for different localities. The speed of the engine is controlled through a pedal operated by the right foot of the driver. The two forward speeds, the reverse and the brake are controlled by a single lever in the right hand of the driver. Any one of these operations can be performed by the lever instantly, and it is not necessary to pass through the intermediate functions.

THE PACKARD GASOLINE CARRIAGE.

Thus, if the brake has been applied and it is desired to put on the high speed at once, it is not necessary to pass through the slow speed, which, if the carriage was running, would make a very unpleasant, if not dangerous, check to the speed. Steering is done by a lever in the left hand. In addition to the hand brake, a powerful foot brake acting on the rear axle is provided. The chain is a special nickel steel roller chain which, under the most severe tests, has shown no appreciable wear and an ample margin of strength. The distance between centers of sprockets is maintained constant, irrespective of the relative motion of the carriage and the rear axle.

The body of the carriage shows the best possible coach work and upholstering, and the aim has been to get rid of the "horse wanted" appearance. The leather dash is not used, but instead a boot or box forming a part of the body. In this is ample space for parcels, waterproofs, etc. The mudguards are ample and are designed more with a view to utility than to carriage appearance. A complete outfit of all necessary tools, wrenches and oilers is supplied with each machine. A chime foot bell is fitted and a single special automobile lamp is fixed to the center of the front spring.

All machines are given a thorough test before they leave the factory. The larger picture shows the testing apparatus used. As there seen, the rear or driving wheels of the machine under test are supported on a pair of endless belts running over pulleys on two parallel shafts. One of these shafts is provided with a brake pulley by means of which any desired load can be applied. A tachometer is attached to the engine, indicating at all times the exact speed, and while on this tester numerous indicator cards are taken from each engine. The machine is run under varying loads and speeds for one or two days on this testing machine and is then, with the skeleton body shown in the cut, taken out for a further and final test on the road. Thus, when the highly finished body of the carriage is fitted, all of the mechanism has been thoroughly tested out and is in perfect running order.

## Locking Mechanisms for Steering Gears.

By P. M. Heldt.

In a previous article the writer stated that for vehicles of great weight and high speed it is necessary to have the steering mechanism irreversible, so that the unevenness of the road cannot be felt by the person steering the vehicle. This irreversibility is obtained either by swiveling the steering spindle in such a manner that the center line of its rotation intersects the vertical center line through the wheel at the point where the latter strikes the ground, or by interposing an irreversible transmission piece between steering spindle and steering lever. As a third choice, we may add a brake to the steering gear, which will hold it in position when once set. In the present article we will consider methods for braking steering gears, and irreversible transmission members which have been applied to steering gears.

In Fig. 1 is shown a steering lever and steering rod, which may be firmly held in position by pressing downward on the steering lever. The steering rod passes through a vertical tube, fastened to the vehicle body. The steering rod is provided with a collar, just below where it passes into the tube, and the tube has a collar at its upper end. The steering lever has the form of a double-armed lever, the short arm of

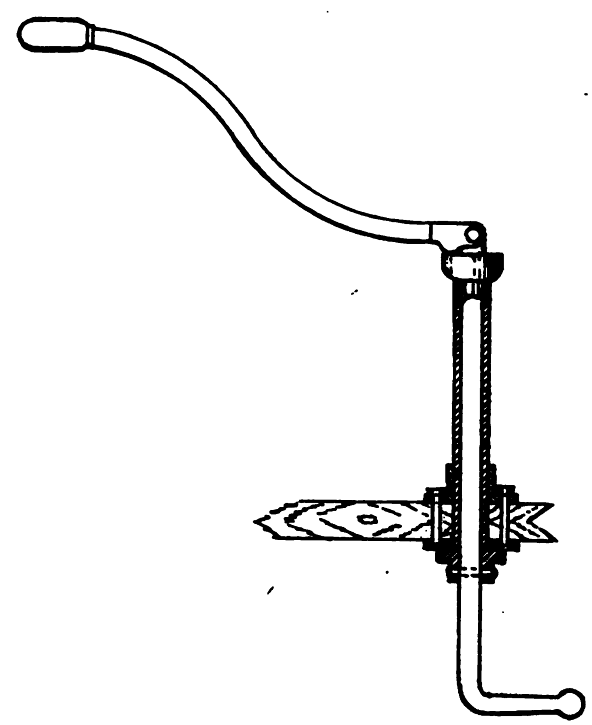


FIG. 1.

which fastens to the steering rod and the long arm of which is held by the operator. It will be seen from the drawing that when the steering lever is depressed the collar on the steering rod is drawn up against a plate on the vehicle body, and the friction between these two pieces will prevent the transmission to the steering lever of any jarring due to running against obstacles in the road.

A steering arrangement of this form is mentioned in one of Mr. C. E. Wood's patents, but to the writer's knowledge is not used by his company.

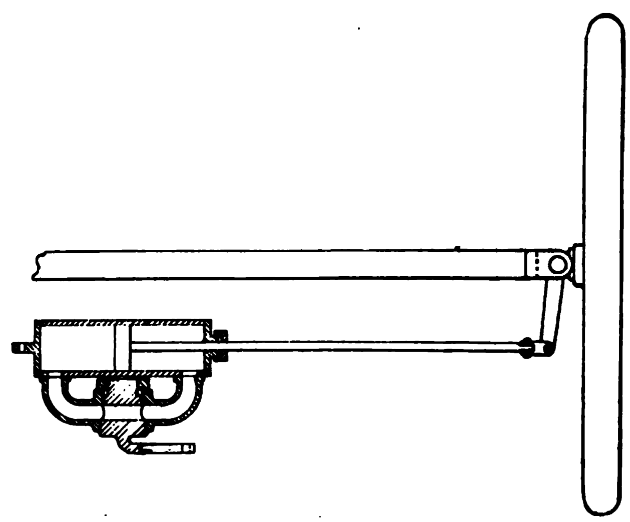


FIG. 2.

The steering mechanism may also be locked hydraulically, as shown in Fig. 2. One of the steering spindle levers is con-

nected by a rod to a piston which moves in a cylinder having both ends closed. The cylinder has a port at each end, and these ports are connected by a pipe containing a valve. Both ends of the cylinder and the pipe are filled with oil. When the plane of the wheel is shifted, the piston is displaced in the cylinder. As a result of this displacement, oil flows from one end of the cylinder to the other, by way of the connecting pipe. As the oil in this case has to pass the valve, the latter has to be opened before the displacement of piston and steering wheels can take place. The valve is therefore connected so that a vertical movement or a twist of the steering lever will open it.

The simplest irreversible mechanisms are the worm and wheel and the screw and nut, and both of these are being used at present to render steering gears irreversible. The former is used by the Cie. Générale des Voitures, of Paris, and the latter by the Canello Durkopp Co. The steering gear of the cabs operated by the Compagnie Générale in Paris has a worm, on the shank of which is fastened a hand wheel with handle. Quite a number of complete turns of the hand wheel are necessary to bring the wheels from extreme position to extreme position. The writer has had some experience with this form of steering mechanism, and finds that the turning of the vertical wheel in front of the operator is very tiring and much less convenient than the operation of the usual steering lever. There is always considerable loss of power with the worm and wheel, and with the large reduction a little play in the connecting links and between worm and wheel corresponds to quite a motion of the hand wheel. The wheels have therefore always a little play, which is very annoying, and necessitates the constant turning back and forth of the hand wheel.

The Canello Durkopp carriage is being steered with the usual hand lever. The vertical rod has on its lower end a sector of a gear wheel, which engages with a pinion. The pinion is keyed to the shank of the screw, and the nut is fastened to one arm of a bell crank lever, the other arm of which is connected, by means of a rod and links, to the lever of one of the steering spindles.

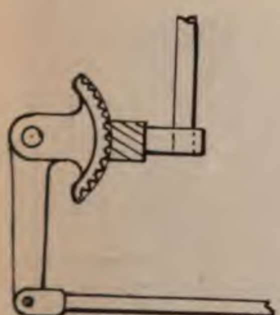


FIG. 3.

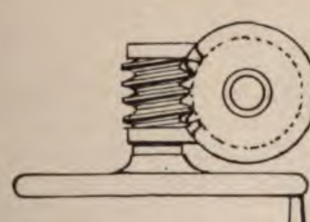


FIG 4

The Columbia Automobile Co. uses two sectors with a helical thread, as shown in Fig. 3. It is a well-known fact that helical gears with teeth of more than a certain difference of obliquity are irreversible. Cast iron having a friction coefficient of .3, spiral gears of cast iron are perfectly irreversible when the plane of contact makes with the plane perpendicular to the driving shaft an angle of less than 18 degrees.

A very interesting irreversible mechanism is that of M. de Konink, illustrated in Figs. 5 and 6, which illustrations are taken from La France Automobile. V is a steering hand wheel

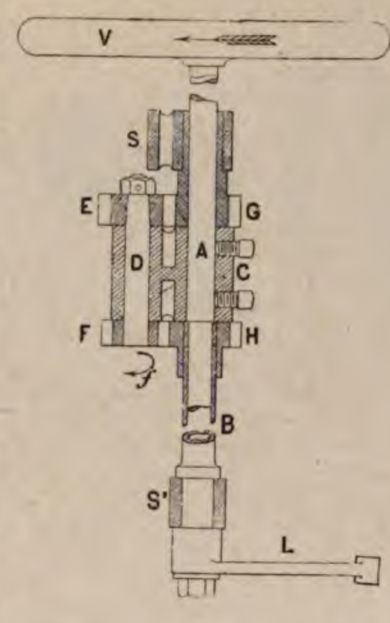




FIG. 5.

FIG. 6.

of the type usual in French automobiles, which is keyed to the steering shaft A. On A is fastened by means of set screws, a casting, C, acting as a bearing for the shaft D. This shaft D turns free in its bearing and has a pinion keyed to it at either end. Pinion F gears with another pinion, H, and pinion E with pinion G. Pinion G is fastened to the stationary bearing S, and pinion H fastened to the shaft B. The shaft B, independent of the shaft A, is guided by the bearing S, and has a lever, L, fastened to it at its lower extremity.

When the hand wheel V, and consequently the shaft A, is turned, the shaft D rotates about the shaft A. Pinion G being stationary, pinions E and F and shaft D rotate also around their axis. Supposing pinions E and G to have the same number of teeth, but F only having four-fifths the number of teeth that H has, then for one revolution of the hand wheel V the shaft D will make one revolution around shaft A, and also a revolution around its axis. The direction of rotation is the same for all three motions. The right-hand revolution of shaft D around shaft A would give the pinion H a right-hand rotation of one revolution, but the rotation of shaft D and pinion F around their common axis reduces this motion by four-fifths of a revolution, and pinion H makes therefore only one-fifth of a rotation, while the hand wheel V makes one, both rotations being in the same direction. The arrangement serves therefore at once the purpose of a reducing gear.

No motion can be transmitted through this mechanism from the shaft B to the shaft A. A motion of shaft D in a certain direction around shaft A is always associated with a rotation of D around its axis, the latter motion being in the same direction. Now a force acting at the point where pinion H engages pinion F, tending to rotate shaft D around its axis in one direction, tends also to revolve it around the axis of shaft A in the opposite direction, and as it is impossble for these two motions to take place simultaneously there will be no rotation at all; in other words, the gear is locked.

Another irreversible mechanism, that illustrated in Fig. 7, has been devised by M. Jeantaud. 1 is the steering shaft, and 2 the steering hand wheel. To the hand wheel is fastened a piece, 3, provided with two hooks, 4 and 4'. On the steering

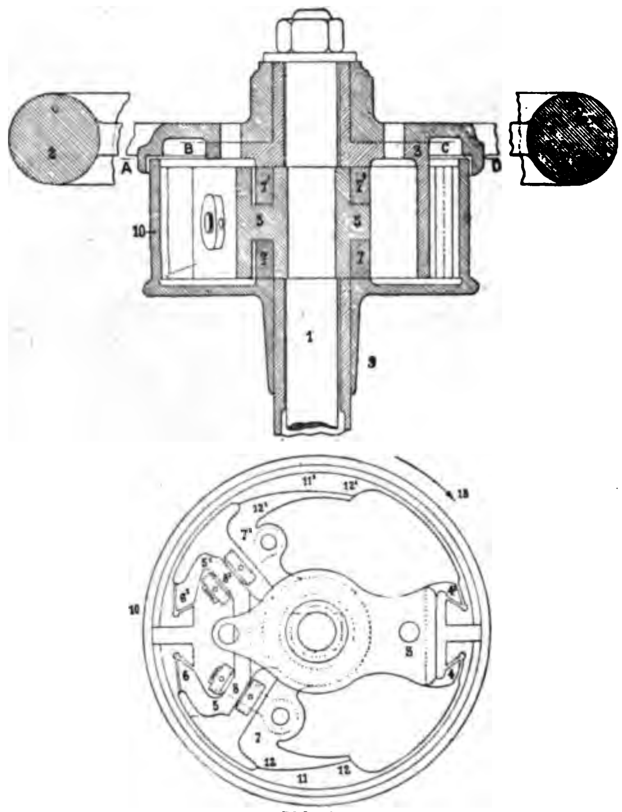


FIG. 7.

shaft is keyed a piece, 5, 5, over the hub of which pass the hubs of two pieces, 7 and 7', which are additionally connected to 5, 5 by adjusting screws 8 and 8'. Piece 5, 5 terminates in two hooks 6 and 6'. On the fixed stand-pipe 9 is fastened a drum, 10, which protects the whole mechanism. Inside the drum there are two flat springs, 11 and 11', which are lined with leather on their convex side, and engage with the hooks 4, 4', 6 and 6'. On the inner side the springs have an inclined surface corresponding to the faces, 12, 12, and 12', 12' of pieces 7 and 7'.

Supposing the hand wheel to be turned in the direction of arrow 13, then the piece 3, by means of its hook 4', takes hold of the spring 11', and by its means piece 5 and steering shaft 1 are turned. The spring on the opposite side is inactive, and is carried along by hook 6. When on the other hand a turning couple is impressed on the steering shaft by the wheels, say also in the direction of arrow 13, spring 11' is pressed outward against the wall of the casing 10, thus acting as a brake and preventing the transmission of the couple to the hand wheel.

First Horse—"I see the finish of the human race."

Second Horse—"What do you mean?"

First Horse—"Just wait until men try to drive those sneaky, treacherous automobiles four-in-hand."



## COMMUNICATIONS.

### The Inventor and the Investor.

New York, May 14.

Editor Horseless Age:

To one who knows what is being done, the inquiry of "Machinist" is not so unreasonable. As a matter of fact, quite a number of ambitious inventors have found people to give them a chance, some working for modest wages with a prospective share in the profits of their inventions, others working in expensive offices and living on the best of the land.

In the one case the men advancing the money are probably induced to do so by the comparatively small outlay and the hope of large reward, and in the latter case no doubt the personality of the inventor is able to duly impress the capitalists with his importance and thus get the larger outlays to carry out his plans. In both cases the financiers know little if anything about the mechanical part of the subject, and there is a direct ratio between the amount of money advanced and the intricacy involved in the apparatus and number of patents applied for. In a case of the first kind known to the writer, a motor and carriage that could run were built, but although the motor had to be discarded because it was found that a two-cycle engine could not be run fast enough, at least a very meritorious and doubtless valuable improvement was made in the ignition apparatus. On the other hand, in two cases of the latter kind I have only been able to discover intricate mechanisms, and in spite of the immense outlays of money no carriages or wagons have been put on our streets. The most that has been done is to show experimental vehicles in a loft.

"Machinist" will, however, have to trust to luck and his own exertions to find some one to supply him with the necessary funds to work out his ideas, or else pay for same out of his savings. H. W. S.

### An Early Traction Engine.

Green Bay, Wis., April 20.

Editor Horseless Age:

In The Horseless Age of April 11 I saw (page 14) a notice of E. P. Cowles' traction engine, patent No. 154,846, Sept. 8, 1874. I inclose herewith a photograph of an engine built under this patent at the East River Foundry & Machine Works, Green Bay, Wis., in 1877, and run in competition for the prize of $10,000 offered by this State. The run was made from Green Bay to Madison (200 miles). Owing to the breaking of a steel casting when 25 miles from Madison this engine failed to meet the conditions. Its weight ready to run was 3½ tons. It had two cylinders, 7 x 11 in. All four wheels were drivers and steerers as well, and were 4 ft. 8 in. diameter and 10 in. face. Besides the guide wheels shown to keep it on the track, it was steered on the track the same as on a common road. It turned curves of 25 ft. diameter [Quære, radius?—Ed.], had three changes of speed, carried 100 gals. of water and hauled a tender containing 300 gals. of water, with fuel. It was a wood burner. Much difficulty was experienced on the way in procuring fuel and water, causing many delays of from 4 to 10 hours.

In November, 1899, it was taken to Quinnesex, north peninsula of Michigan, and run from that point 30 miles through the woods over a "toting" road for the lumber camps to a point on the Bruly River, where it hauled 5,000,000 ft. of pine logs over a "pole" road. The photograph was taken at this point, while working in this capacity.

The run from Quinnesex was probably the most remarkable ever performed by any motor vehicle, and I venture to say that none other ever built, or that ever will be built, could do it.

The ground had previously been frozen 8 in. deep, and a thaw at this time put it in the condition of a spring "break-up," making the road impossible for hauling teams; and in addition there were many not very long but very steep hills to climb, and, what was worse, to descend. It was accompanied only by its tender, a crosscut saw, two axes and two pails. It forded streams and took water and cut wood by the way, as there was only one log house the entire distance.

After this it returned to Green Bay and was worn out as a threshing engine. It has run over every kind of road in every possible condition, and over plowed fields and across country where there were no roads.

It never met a hill that it could not climb. It ran altogether more than 25,000 miles, or far enough to reach once around the world at the equator. It could easily make, and has often made, 20 miles per hour over country dirt roads fairly level.

If certain inventors with automobile patents will observe the photograph carefully they will see "There is nothing new under the sun."

Several engines were built after this patent, but, like many another invention, it was 30 or 40 years "too previous." It was too expensive for threshing, and the lack of good roads prevented its use for any other purpose.

C. W. STRECKENBACH.

[The photograph shows horizontal idler or guiding wheels, with vertical axes, which take the place of flanges by bearing against the "poles" on which the driving wheels run. They are barely visible in the half-tone.—Ed.]

## Use of Variable Cut-off.

New York, May 11.

Editor Horseless Age:

I would like to get information through your columns whether the reversing mechanism of a steam carriage can be used to give a variable cut-off. I have been led to assume by my reading and conversation with engineers that the position of the reverse lever determines the amount of steam admitted to the cylinder, that the nearer it is moved toward midway between its forward and backward position, the smaller is the charge of steam admitted to the cylinder. Is this so? And why can it not be made use of in the carriage that "Steam Carriage" has used? I presume it cannot be employed on his carriage, as he says that one of the points of the ideal steam carriage would be some "means of adjusting the cut-off so as to use steam expansively on occasion."

INTENDING PURCHASER.

[Most of the steam carriages now on the market do use a variable cut-off. The superior economy of an early cut-off under light load, instead of throttling, is well known. It is a matter of some skill to adapt it to vehicle work, but when this is successfully accomplished there is no question of its advantages. To apply it to a throttling engine would necessitate re-designing the engine.—Ed.]

## A Steam Boiler.

Findlay, O., May 10.

Editor Horseless Age:

Referring to the small water tube boiler shown in your Steam Boiler Number, designed, I think, by Mr. Burr, will you kindly state through your paper the number of square feet heating surface it would require to develop 3 h.p.? Also would it not be as good to make the heads of malleable iron castings instead of steel? H. F. LAUGHLIN.

1. About 30 sq. ft.
2. Yes.

AN EARLY TRACTION ENGINE.

## OUR FOREIGN EXCHANGES.

### The Georges Richard Voiture.

The latest type of Georges Richard gasoline vehicle differs from the earlier ones in having the motor in the front portion of the frame instead of at the rear. The Motor-Car Journal publishes the accompanying general view, and the following description is condensed from La France Automobile.

The frame, shown in Fig. 1, is of channel steel and is of great strength, as befits a vehicle designed for touring and not for racing. The axles are of 38 mm. (1½ in.) section and 1.35 m. (54 in.) gauge between wheels, and the frame rests on them through the medium of the springs shown in Fig. 1.

The motor, of from 7 to 10 h.p., according to size, is of the twin-cylinder opposite-crank type, with cylinders and water jackets cast in one piece. Instead of casting the crank case in one piece inclosing the cranks, it is made without an upper half, and the lower half, whose top edge runs up to meet the flange at the base of the cylinders is made stiff enough to serve as a frame, and the bearing caps are bolted to it. A light removable cover is then fitted to exclude dust and retain the oil. The left-hand end of the crank shaft has a pinion next to the bearing, and outside of it is a socket for receiving a starting crank. The pinion drives a water pump gear i (Fig. 2) and also the secondary or cam shaft gear. To the latter is fitted a speed governor which is one of the distinctive features of this vehicle. In Fig. 3 is shown an enlarged view of the cam shaft gear, with the governor attached. The latter con-

THE GEORGES RICHARD VOITURE.

The wheels have phosphor-bronze hubs and spokes of acacia wood, and the tires are solid or pneumatic, at option. Fig. 1 shows the mechanism with the body removed. The motor and all other parts are connected rigidly to the frame, the springs just mentioned relieving the wheels of their direct weight. The motor is placed horizontally beneath the front bonnet with the cylinder heads forward. Its crank case is seen at B, Fig. 1, and P is the fly wheel. Bolted to the latter is a pulley, over which runs a belt, which passes under the idler G and around the pulley P', which is concentric with a gear-carrying shaft in the case B', and is connected thereto by a friction clutch.

This will be more fully described later; it is sufficient at present to say that this shaft transmits the various speeds by gears to the secondary shaft, whose outer ends carry the sprocket pinions shown, and which is split for the differential. The heavy diagonal lines show, one the rod controlling the changes of speed, and the other that controlling the reverse. The brake shaft w, between the idler G and the crank case, applies brakes to drums on the rear wheel hubs and also to a drum between the pulley P' and the gear case B'. The cooling tubes R R are seen over the rear axle, and the water tank is just back of them.

sists of two weights a a, pivoted at n n and normally drawn toward the shaft by the springs p p. As they are carried apart by centrifugal force, their bell crank ends c c shift the sleeve m axially along the shaft. One of the exhaust valve stems is shown at Z (Fig. 2), and the other is like it, on the other side of the engine, each being operated by its own lever Y and its own cam. The cam shaft, and with it the cam sleeve m (Fig. 3), therefore extends clear across the engine; and the cams are so arranged that one cylinder at a time is cut out of action by its exhaust valve remaining closed, owing to the axial shifting of the cam. The first cylinder is wholly cut out; but the second is cut out only by thirds—i. e., the exhaust valve may close when the piston has accomplished two-thirds or one-third of its exhaust stroke, thus entrapping the remainder of the burnt charge to dilute the fresh mixture. An attachment is provided, but not shown, by which the cam sleeve may be shifted by hand. The normal speed is 700 or 800 r.p.m., but this may be varied from 400 to 1,200 r.p.m.

Ignition is by jump spark, using the sparking plug illustrated in The Horseless Age of April 4. The casing which incloses the governor carries a cam piece x (Fig. 3), which makes contact successively with rollers on the ends of two

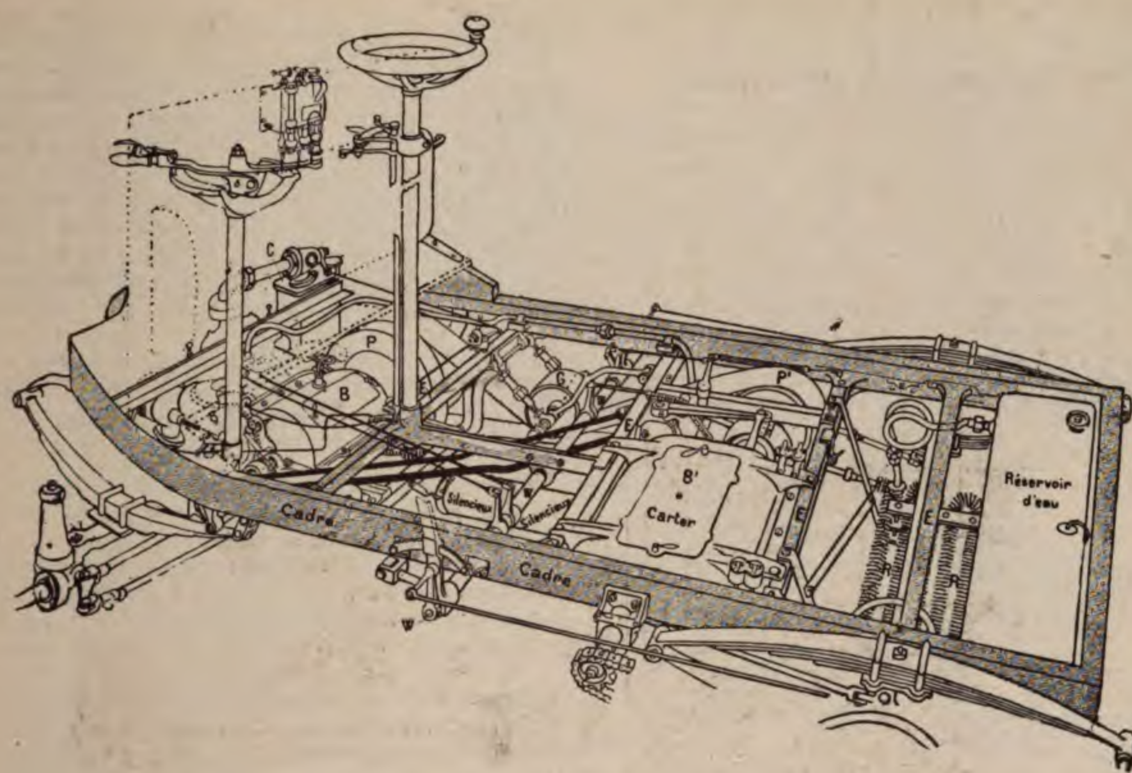



FIG. 1.

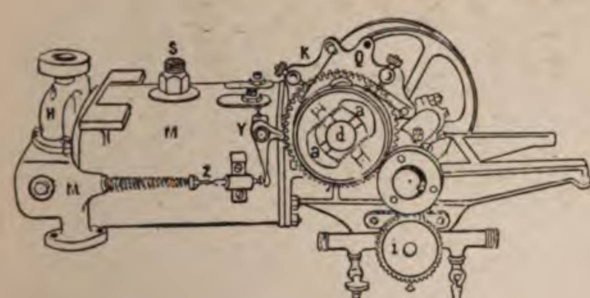



FIG. 2.

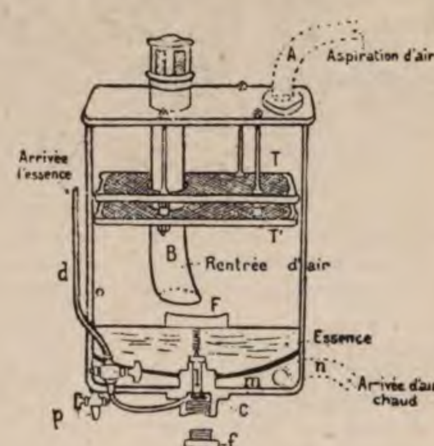



FIG. 4.

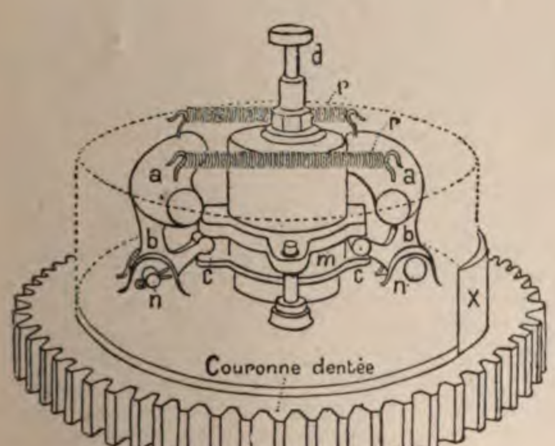



FIG. 3.

springs, seen in Fig. 2. These springs are held by studs in the insulating plate Q, and when a roller is pressed outward by the revolving cam piece the spring makes a second contact with a platinum-tipped screw adjustably mounted in a stud, thereby completing the primary circuit. These studs are 90 degs. apart, and one is connected to each igniting plug. The insulating plate Q can be shifted about the cam shaft center, carrying the contact springs with it and thus providing for ignition lead. The inlet valves open vertically downward, and are covered by the branched pipe H, which connects them with the carbureter C (Fig. 1) and delivers the mixture.

The carbureter acts by surface evaporation, and is shown in Fig. 4. The air enters by B, and goes out by A, the gauze sheets T T' being interposed to prevent liquid gasoline from being carried upward by splashing. The float F, spring-con-

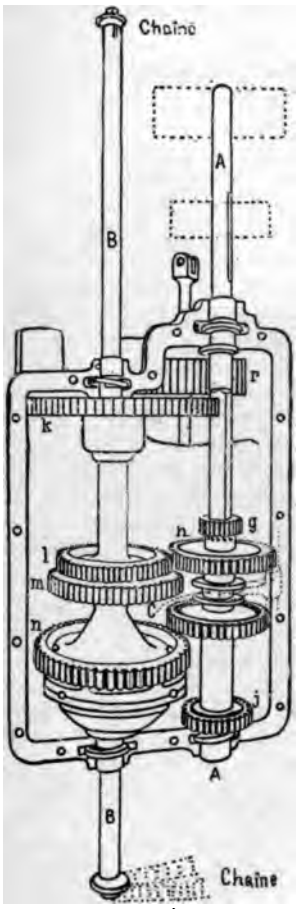



FIG. 5.

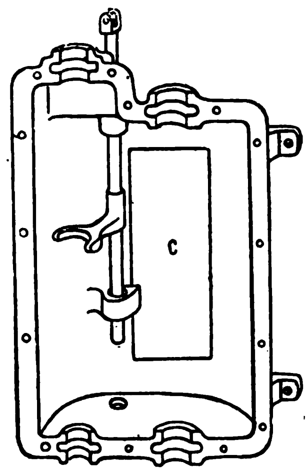



FIG. 6.

nected to the stem L, closes a conical valve at the lower end of the latter when the gasoline level is too high. Gasoline enters by the tube d, and the plug f is for cleaning. Hot air from the exhaust enters the space m and helps to vaporize the gasoline.

Fig. 5 shows the speed changing gears in plan, and Fig. 6 shows the cover of the gear case, inverted. The pulley and brake drum are indicated on the driving shaft by dotted lines, and the position of the shifting fork F is shown dotted at C (Fig. 5). The differential on the shaft B is seen at the left hand or bottom of the gears. The gears j, i and h give forward speeds from the slowest to the maximum, while pinion g, connecting gears k and r when the latter is shifted into line with k, supplies the reverse. It will be understood that all the gears j, i, h and g are on one sleeve, which is splined to the shaft A and revolves with it; also that the gears are so spaced that they engage and disengage in succession by a progressive movement of the sleeve.

In connection with these speed-changing gears, the clutch previously mentioned as connecting the pulley P' (Fig. 1) to its shaft is used to disconnect the shaft from the driving power, so that it can assume at once the velocity corresponding to the pair of gears thrown into engagement. It is used also, of course, when it is desired to stop the carriage, but not the motor. The clutch is operated by a pedal which actuates a rod working on one of the arms on the shaft w (Fig. 1). Another arm on the shaft, nearly in line with the pulley, disengages the clutch, and a tension spring holds the latter normally in engagement.

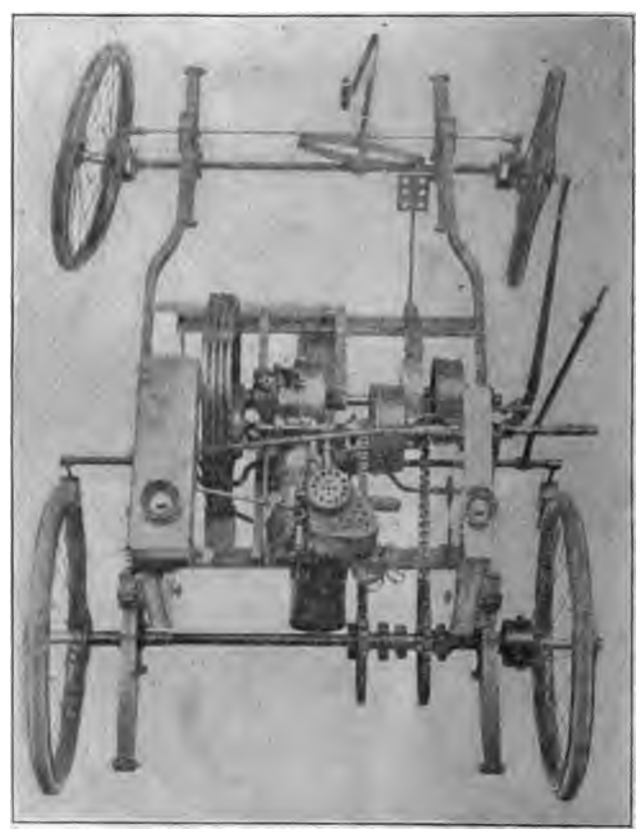
To brake the carriage, a second pedal beside the first is provided, which first disengages the clutch and then applies the brake on the drum of the shaft A (Fig. 5). The brakes on the rear wheel hubs are operated by a hand lever, which, like the brake pedal, disengages the clutch before the brakes grip. Oil wells and rings are provided for the shafts A and B (Fig. 5), as shown, and the gears run in oil.

Steering is accomplished in the manner usual with French vehicles, by a hand wheel and pinion, which latter meshes with a toothed sector connected with the steering axles.

## Some British Novelties.

Among the minor novelties shown at the Motor-Car Exhibition, Islington, is a unique water-cooling coil made by F. C. Blake, Hammersmith, consisting of a copper tube to the outside of which are soldered six copper gauze pipes. It is said that from 2½ to 4 ft. per indicated horse-power is all that is required, while the ⅝-in. size weighs only ½ lb. per foot.

Messrs. Roots and Venables, 100 Westminster Bridge Road, S. E., exhibit their well-known kerosene vehicles. They have two seats, and carry a 3-h.p. horizontal motor using kerosene as fuel instead of gasoline. The cylinder is water jacketed, the tank having a capacity of oil and water for about five hours. Two speeds, 2 and 14 miles per hour, are provided. The countershaft is chain driven, while the connection between the



RUNNING GEAR OF ROOTS KEROSENE CAR.

countershaft and the rear road axle is also by chain gearing and friction clutches. The low-speed chain is provided with a spring idler to take up any slack, while for a similar purpose the rear axle is so arranged as to be capable of being moved on the springs. A feature of the Roots car is the water condensing coil, which consists of a series of copper tubes fitted round the fly wheel in such a way that the latter works within the coil. The car weighs, complete, about 6 cwt., and is fitted with wire spoke wheels and solid rubber tires. We understand that a number of this style of car have been sold to automobilists in India, where the use of petrol is not permitted.

The Locomobile Co. of America exhibits two carriages, one of which is fitted with a cooling tube to condense the exhaust steam.

We are indebted to the Motor-Car Journal for the illustration.

## Oils as a Source of Energy in Explosion Engines.

The great merit of the oil engine as a source of power is its economy of fuel. It is this feature which renders the future prospects of the oil car in competition with its formidable rivals—steam and electricity—so satisfactory, and the equanimity of its supporters, despite the difficulties with which they have to contend, so hard to disturb. Whatever the steam car and the electric car may be, the oil car will probably always hold its own, especially when we consider the strides that have been and are being made to eliminate its most objectionable features—the noise and smell of the exhaust and the vibration—which have largely characterized it in the past. At the same time, the introduction of variable speed oil engines is tending very largely to increase the flexibility of oil as a motive power. Certain aspects of oil fuel as applied to oil engines, therefore, possess an interest for those engaged in the development of the industry and for the general public as well.

The chief sources of the oils employed as the motive power of oil engines are the oil wells of Pennsylvania and those of Baku and its neighborhood on the shores of the Caspian. The crude oil which rises to the surface of its own accord, owing to the pressure it is under in the oil-bearing stratum into which the bore hole or oil well is driven, is a thick oil, usually about the color of treacle. This crude product is first of all dealt with in large boilers, in which it is subjected to fractional distillation. The temperature is gradually raised to about 150 degs. and maintained at that point for some time. During this part of the process the light oils—the gasolines, benzolines, and "motor car spirit"—distil off and are collected by ordinary condensation. Their specific gravity is generally from about .60 to .70. The temperature is then considerably raised and the distillation of the heavier lamp oils of a gravity of about .75 to .85 effected. These are subsequently decolorized by a sulphuric acid and washing treatment. The light oils, generally known as benzoline, gasoline, or motor car spirit, obtained as above described, are, it must be remembered, never benzine (more correctly benzol), but the more volatile members of other hydrocarbon series. The American oils, whether light or heavy, are members of the paraffin series, the lamp oils varying in composition from about $C_8H_{18}$ to $C_{16}H_{34}$. The oils of Baku, according to the Russian chemist Markonikow, who has devoted much study to the subject, are not paraffins, but olefins, belonging to the series $C_n H_{2n}$, the lamp oils from this source varying from about $C_8H_{16}$ to $C_{15}H_{30}$. A very important fact which cannot be left out of sight when considering the future of the oil motor is that the output of every natural source of petroleum is about at least eight times as much heavy or lamp oil as light oil of the "motor car spirit" type. It would seem to follow, therefore, that the price of the latter must always be considerably higher than that of the former.

The relative merits of different oils as heating agents, and notably of the heavy oils as opposed to the light oils, appears to be shrouded in considerable obscurity. Hydrogen is a very much better fuel than carbon, and it has been customary to assume that, with a hydrocarbon, the heating capacity is proportional to the amount of hydrogen it contains; thus marsh gas is a better fuel than ethylene, and Mr. Boverton Redwood has found that the heating value of the heavier Russian oils is almost exactly in proportion to their content of hydrogen. This is not, however, the case with all hydrocarbons; there are certain anomalies. Thus, acetylene contains only half the hydrogen of olefin. It is, however, a slightly better heating agent, and a heavy American oil of gravity .841 has been found to have calorific value of 18,401 units, as against 11,000 units given by a gasoline of the same type, with a gravity of about .69. Generally the American gasolines appear inferior as fuels to the American heavy oils, while with the Russian oils the reverse is the case. The anomaly may be due to the manner in which the carbon is combined with the hydrogen. In certain cases there is probably an absorption of heat due to the decomposition of the hydrocarbon. In other cases this does not appear to occur. Where such an absorption of heat takes place, the heat going to decompose the hydrocarbon would have to be subtracted from that produced by its combustion. This is the general rule with chemical compounds. The heat generated by their combustion has to be supplied to effect their decomposition, and the anomaly with the hydrocarbons is that some of them appear to give the full heating value of their elements without any such loss.

These estimates of the calorific value of the hydrocarbons are all made out on the basis of their steam-raising capabilities, or, in other words, their power when burnt to raise the temperature of a given weight of water. When employed as fuel in the cylinders of explosion engines the conditions are so different as to far more than outweigh any of the above indicated anomalies.

The majority of oil engines employing the heavier oils as fuel hitherto in use belong to a totally different type of machine from those using gasoline or spirit. The output of the former, for size and weight of engine, is less, and their consumption of oil per horse-power hour produced is considerably higher than with the latter types of motor. Let us consider how far this comparative inefficiency is inherent in the oil. The great majority of heavy oil motors subject the oil to preliminary treatment in a vaporizer, which is first of all heated up by external means, and subsequently, though not always, kept hot by some of the waste heat of the engine. These motors may be again subdivided into two classes: (1) Those in which the vaporizer is kept hot enough to fire the explosive mixture automatically at the end of the compression stroke; and (2) those in which it is hot enough to

vaporize the oil only, additional means having to be supplied, such as an electric spark, to effect the ignition of the charge at the right moment.

In the first of these classes there is practically no question that the vaporizer acts as a gas producer, and that the engine is really running like an inefficient gas engine. The oil squirted into the red-hot vaporizer is "cracked," exactly as in the manufacture of oil gas, into permanent hydrocarbon gases and tar, which ultimately decomposes into carbon and then burns off. Mr. Worby Beaumont, taking into consideration the fact that such an engine when running properly does not become choked with tar or carbon, has advanced the theory that when petroleum oil is brought into contact with a red-hot surface when air is present, it is not cracked up in the same way as when air is absent, as in a retort. The formation of tar, however, in the manufacture of oil gas cannot be prevented by admitting air into the retort. It seems more probable that tar and carbon are formed, though they may burn off partially all the time the engine is running and the vaporizer is hot enough. When once the growth begins its increase is rapid. This is one very important cause of inefficiency in this type of engine. The oil admitted to the vaporizer is split up into two products, one alone of which—the permanent gas—gives energy to the cycle by exploding at the right moment. The other product—the tar and carbon—fails to contribute any material amount of energy to the piston. This is one reason why these engines obtain from their heavy oil fuel less energy than they should. Another reason is their essentially slow combustion. But slow combustion means low horse-power per unit of fuel, because it means less of the energy of each explosion going to propel the piston, and more of it going to heat the cylinder wall, exhaust passages and the water jacket.

The other types of engine in which the vaporizer is not kept at such a high temperature or utilized for firing the charge automatically on compression, but which rely on other means to effect the ignition, differ a good deal in some features from the foregoing. It is doubtful whether the same kind of cracking up takes place. Probably what occurs is not the production of tar, but a mixture of heavier and lighter hydrocarbon vapors—the heavier vapors being probably difficult to ignite rapidly. This may help to explain a common feature in both types of engine—the relatively imperfect combustion effected and the consequently smoky exhaust. Recondensation of the less perfectly gaseous elements of the mixture during the intake stroke of the engine tends to increase this effect—the explosion finally vaporizing them too late for use.

The principal feature, however, possessed in common by both these types of motor is that the oil vapor or gas is introduced into the cylinder in a heated state. The result of this is that it is very difficult to get the mixture sufficiently dense to obtain explosions of maximum efficiency, and this is perhaps the most fertile cause of all in lowering their fuel efficiency, and is a defect from which the gasoline engines are relatively free.

Broadly speaking, the gasoline engines may be divided into two classes: (1) Those which employ a carbureter; and (2) those which spray the oil in a mixing chamber more or less immediately communicating with the inlet valve.

The carbureter is an appliance by which air is brought into close contact with the gasoline over an extended surface, and is in every way comparable to the ether saturaters employed in the production of limelight. The result is to produce a highly carburized inflammable air, and engines working on this principle are to all intents and purposes gas engines.

In the other type a mixture of vaporized and finely sprayed gasoline finds its way into the cylinder, and, becoming fully vaporized on compression, produces a denser and consequently more economical explosive mixture. It is no matter for surprise, therefore, that this type of gasoline or light oil motor develops from 15 per cent. to 20 per cent. more power from the same oil than the former type. Both classes of gasoline motor also work with a very readily fired and rapidly burning fuel. They can therefore run at very high speeds. Here, therefore, we have the solution of their greater economic efficiency; they are able to run at higher speeds, utilizing more of the energy of their explosions in propelling the piston and less in heating the cylinder walls, and they introduce their vapor or mixture of spray and vapor cool into the cylinder and consequently produce more powerful and more economic explosions. That a given weight of gasoline or spirit has been found capable of producing more power than heavy oil is due, therefore, not to its superiority as fuel, but to the characteristics of the motors in which the light and the heavy oils have hitherto respectively been used.

The problem is apparently altogether different when we employ the light and heavy oils under similar conditions. With an engine in which the oil is sprayed directly into the cylinder we have reason to believe that the consumption of oil of comparatively high gravity is less per horse-power hour developed than when using lighter oil, provided that complete combustion is obtained. Mr. Dugald Clerk, who, as is well known, has made careful experiments on the subject, states that light oil vapors will stand a higher degree of compression than the vapors of heavy oils without undergoing spontaneous ignition. If this is so it would seem to lead to the conclusion that the dissociation temperature of the lighter oil is greater than that of the heavier oil—i. e., that the amount of heat lost in decomposing it is greater than in the case of heavier oil, and that it is therefore not so good a fuel as its chemical composition would lead us to expect. This quite agrees with the data furnished by its direct employment in the cylinder under analogous circumstances.

The fact, then, that under similar conditions heavy oil is not inferior as a source of power to light oil, but, on the contrary, rather superior, is encouraging for those who, in spite of the many difficulties with which the problem bristles, are working for the development and improvement of the high-speed heavy-oil motor. Two other facts may serve to encourage them. One is the essentially greater cheapness of the heavier oil, due to its being produced by all oil springs in much greater quantity than the light oil, as pointed out above. The other is the considerably greater amount of trouble, expense and precaution involved in the transport and storage of the lighter oils. These are essential to their nature and composition, and will always tend to restrict their cheapness and the opportunities of readily procuring them.—The Automotor Journal.

## Magnalium.

A new alloy, possessing considerable advantages over aluminum in regard to lightness, tensile strain and malleability, is announced from Austro-Hungary. It is the invention or discovery of Dr. Ludwig Mach, and consists of aluminum and magnesium in varying proportions. Experiments in this direction appear to have been made as long ago as 1866

by Wohler, who produced an alloy of 30 per cent. magnesium and 70 per cent. aluminum. This alloy was, however, found to be quite devoid of any commercial or other good qualities, and further experiment on the same lines does not appear to have been undertaken. Dr. Mach satisfied himself that the bad qualities of Wohler's alloy were entirely due to the impurity of its constituents. At the present day both magnesium and aluminum can be obtained, thanks to the electrolytic method of their preparation, in a condition of almost absolute purity. To this is probably due the more satisfactory character of Dr. Mach's results as compared with those of the earlier experimenters. The compositions of the alloys with which Dr. Mach has experimented vary from 10 to 30 per cent. of magnesium with 90 to 70 per cent. of aluminum. The alloy containing 10 per cent. of magnesium corresponds in general metallurgical character to rolled zinc; with 15 per cent. magnesium to good quality brass; with 20 per cent. to mild bronze, and with 25 per cent. to hard bronze. The alloy with 30 per cent. of magnesium possesses considerable hardness, and is specially suited for the manufacture of various parts of instruments of precision, and, as it takes a high polish, to the construction of mirrors. The tensile strain of the alloys varies from 30 to 42 kilograms per square millimeter (4,200 to 5,900 lbs. per square inch), with an elongation of 50 per cent., according to the percentage of magnesium—the more magnesium the higher the tensile strain. The alloy is of course lighter than aluminum, and its melting point is between 600 degs. and 700 degs. C. It can be most satisfactorily turned, bored and planed; but a certain reserve appears to be maintained in regard to the manner in which it behaves when brazed and soldered. It can, however, be cast very well. The price of magnalium is at present pretty high, but as the cost of magnesium, its most expensive constituent, is likely to diminish with increased demand, that undesirable feature will probably undergo favorable modification. Considering the ever-increasing rôle which aluminum continues to play in the construction of the lighter types of motor vehicles, the introduction of magnalium at a reasonable price is a question of considerable interest for all concerned in the motor car industry.—The Automotor Journal.

## The Berlin Iron Bridge Co.'s New Plant.

The Berlin Iron Bridge Co. have had a long and wide experience in both designing and building manufacturing plants, and they are now turning this to account in their new branch plant at Pittsburg, with the intention that it shall be the most complete and best equipped of its kind in the world. They have bought 50 acres of land between the Pennsylvania Railroad and the Ohio River, upon which they will locate their plant, and in addition 50 acres back from the river, and upon this latter piece they will put up a number of houses for the use of their employees. The foundations for the buildings are already in place, and it is the intention that this plant will be in complete operation by the first of July, as the orders for the machinery equipment have been placed for some months.

The office building will be 60 ft. square and four stories in height, and will be a fireproof construction throughout. The template shop will be 60 ft. in width and 300 ft. in length, two stories in height. The main shop will be constructed entirely of steel and glass, and will be 220 ft. in width and 700 ft. in length. The entire plant will be equipped with new machinery of the heaviest and most modern design. Besides the steam engines for running the dynamos, there will be two three-cylinder Nash engines of 50 h.p. and one of 100 h.p., belted to air compressors and running on natural gas. The electric equipment includes, among other items, one slow speed four-pole belted dynamo of 30 kilowatts at 125 volts and 675 r.p.m., a slate switchboard of the latest type, five 10-h.p. motors, three 15-h.p. and three 5-h.p. motors, all the above being furnished by the General Electric Co. The floor surface of the main shop will be served by 18 pneumatic traveling cranes, mostly of 10 tons capacity and of spans from 20 to 130 ft., furnished by the Chisholm & Moore Mfg. Co., of Cleveland. The Brown Hoisting and Conveying Machine Co. will furnish a 10-ton "locomotive" or self-propelling steam crane, which runs on tracks of standard railway gauge and will lift a 10-ton load at 12-ft. radius, or 4 tons at a 26½-ft. radius. The Cleveland Punch & Shear Works Co. furnish eight punches of 26-in. depth of throat, and two of 48-in., also a rotary planer mounted on a circular turntable, and having a 50-in. head and 12ft. bed. The Hilles & Jones Co. supplies special bridge-shop punches, a beam and channel coping machine, plate straightening rolls and heavy plate shears; and the Niles Tool Co. supplies a Long & Allstatter double angle shear. The hydraulic plant will be very elaborate, and will be furnished by Wm. H. Wood, of Media, Pa.

The capacity of the plant will be from 3,000 to 4,000 tons per month.

## A Kerosene Launch Engine.

We show an illustration of the New York Kerosene Oil Engine Co.'s 5-h.p. marine engine, mounted on an industrial base. The internal action of this engine differs from that of most kerosene engines, in that the oil is not injected till near the end of the compression stroke. This enables a high compression to be used—over 80 lbs. gauge—and the oil ignites at once on contact with the unjacketed and hot cylinder head. By this means premature explosions are avoided, and the oil vapor cannot condense on the cylinder walls.

## MINOR MENTION.

The Hanford Automobile Co. has been incorporated with a capital of $6,000 to do business at Hanford, Cal.

Frank F. Weston, of Elmira, has taken the Locomobile agency for Chemung and several other counties of New York State.

Albert C. Bostwick, of the Automobile Club of America, is reported to have purchased René de Knyff's racing machine for $12,000.

It is said that a census by the French Intelligence Office has revealed that there are just 5,166 automobiles of all kinds in France.

The Crest Mfg. Co. announces the removal of its Dorchester office to No. 83 Portland St., corner of Broadway, Cambridgeport, next to its factory, and at the new location will be glad to welcome its customers and friends.

The United Power Vehicle Co. has been incorporated in West Virginia. The capital is $1,000,000, and the incorporators are James McNab, James Hood, George Hollinshed, H. H. Willis and Cameron Blakie, all of Brooklyn, N. Y.

The Overman Automobile Co. has been incorporated under New Jersey laws with a capital of $250,000. Albert H. Overman, of Springfield, Mass., and Wm. R. Warren, Henry R. Bradbury, Daniel Rianhard and Wm. P. Williams, all of New York, are the incorporators.

The Lunkenheimer Co., Cincinnati, have sent us their complete catalogue of valves, lubricators, injectors and other steam and gas engine specialties of all kinds. It is intended chiefly for the trade, and they issue special circulars of the individual classes of goods.

The Cooke Locomotive and Machine Co., of Paterson, N. J., is building a heavy steam truck under the Thornycroft patents, from drawings sent from England. We believe it is the only one of its kind under construction in this country. It will have a 25-h.p. engine and water tube boilers, carrying 200 lbs. pressure. Egg coal will be used for fuel.

The Marshall & Huschart Machinery Co., Chicago, has sent us their catalogue of machine tools. It is gotten up in the most up-to-date style, with a handsome and wholly unique cover, and it contains a very complete list of machines for all classes of work, general, special and automatic, from bench grinders to Spencer screw machines, by the best known builders.

The *Post* and *Telegram*, of Bridgeport, Conn., are getting up a parade of automobiles to take place July 4 at 10 A. M. T. E. Griffin, of Bridgeport, offers a handsome trophy for the best decorated vehicle, and owners and manufacturers of automobiles everywhere are invited to participate. Those wishing to do so should write at once to George W. Hills, The Post Publishing Co., Bridgeport, Conn.

The Bethlehem Steel Co. send us a book of photographs taken at their mines in Cuba and at their plant in South Bethlehem, Pa. The latter include all departments of the plant and shops, and show also numerous specimens of ingots, forgings, armor plate, and finished work produced by them. Noteworthy are photographs of Krupp armor plates after test, of the 28,000-lb. nickel steel armature rings for the Niagara Falls dynamos, and of large marine and stationary crank shafts. The photographs of their great forges and presses, notably of their 14,000-ton hydraulic press, worked by a 15,000-h.p. engine, give an idea of the great scale on which modern metallurgical work is carried on.

Gould & Eberhardt, Newark, N. J., send us a beautifully gotten-up pamphlet describing and illustrating their "New Type" of Victoria automatic gear cutting machines. Among the special features of these machines are: The use of spiral gears throughout, only one belt being used on the entire machine; the ability to divide and cut all numbers of teeth from 10 to 100; the use of a spiral rack instead of a screw to feed the cutter slide, and the use of change gears to obtain different rates of cutter feed. When a gear blank has been put in place and the machine started, no further attention is required till the work is finished.

The New Jersey Electric Vehicle Transportation Co. has arranged to install automobile stations during the coming season at the following points on the Jersey coast: Seabright, West End (Long Branch), Allenhurst, Spring Lake and Atlantic City. At each of these stations Columbia vehicles, both electric and gasoline, of various designs, will be for sale, and a specialty will be made of charging and caring for Columbia automobiles owned by private parties. The location of the various stations insures proper accommodations for vehicles and offers a large field for driving. Park wagonettes and omnibuses will be available for special service and for parties wishing to make trips through the surrounding country.

## METROPOLITAN NOTES.

Small gray iron castings for motors are being made by the Payne Co., of Elmira, N. Y., and 120 Liberty St., New York.

C. D. Cooke, Vernon Royle and E. T. Bell, Jr., members of the North Jersey Automobile Club, are users of the Loftus Injector.

Hurd & Co., 570 West Broadway, New York, engineers and machinists, have recently fitted up a plant for model work and motor vehicle specialties.

The "Baldwin" and "Full Moon" acetylene lamps mentioned in our last issue, are manufactured by A. H. Funke, 103 Duane St., not by Hermann Boker, as there stated.

A large show room has been hired by R. G. Dubois on Vesey St., at the rear of the Collins Press building, for the exhibition of his portable houses. He has them all ready for inspection.

The Iron Clad Mfg. Co., 22 and 24 Cliff St., New York, is introducing an air-tight gasoline storage tank, which is made of sheet steel with all seams rolled, no rivets being used.

We have received the March, 1900, catalogue of the Garvin Machine Co., containing a very complete illustrated list of milling machines, drill presses, screw machines and other automatic and special machinery for rapid production in duplicate.

The Hayden & Derby Mfg. Co., of 89 Liberty St., claim that out of one hundred of their new size Loftus injectors recently manufactured, eight are in use by owners of automobiles. Some of the citizens of Paterson, N. J., have a practical yet novel way of using them. When out of water, they can attach an extra piece of rubber hose, "which they carry for the emergency," to one end of the injector, stop at a convenient brook and draw from thence all the water they need into their boilers.

# MOTOR VEHICLE PATENTS
## of the world

## UNITED STATES PATENTS.

648,078—Steering Device for Automobiles.—J. H. Pope, Brockton, Mass. April 24, 1900. Application filed Nov. 4, 1899.

The construction and use of this invention are apparent from the drawings. In the form shown, it would appear to be defective from the fact that it swivels both wheels through the same angle, instead of through such different angles that the axes of both hubs when, prolonged, will intersect the axis of the rear wheels at the same point.

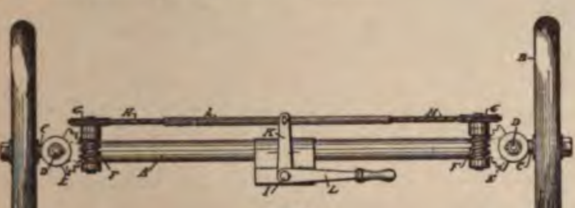


FIG.1.

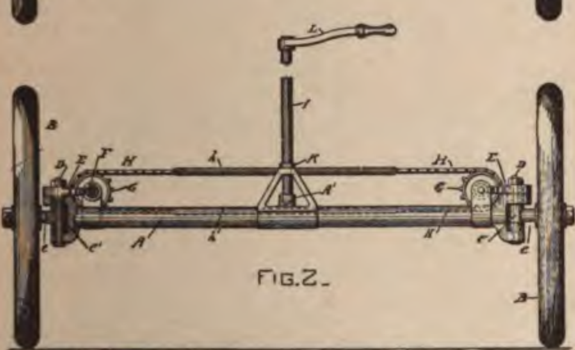
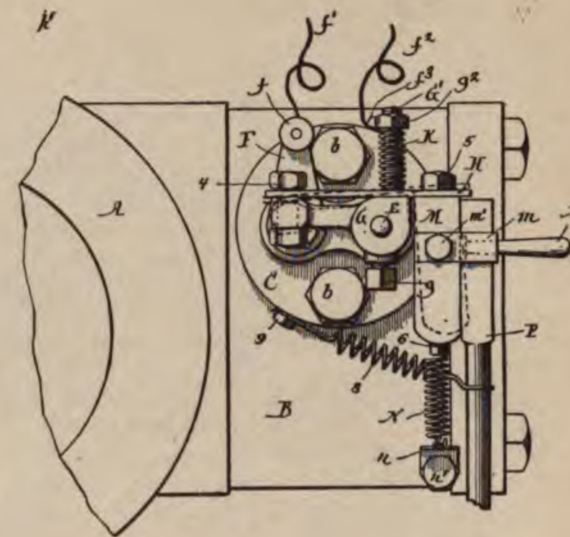


FIG.2.

648,122—Electric Igniter for Explosive Engines.—Wm. F. Davis, Waterloo, Ia., assignor to the Davis Gasoline Engine Co., same place. April 24, 1900. Application filed May 22, 1899.

In the figure, A is the cylinder head and B the valve box. The movable electrode is mounted on a stem, E, and the latter terminates in a finger inside the valve box extending to the left, so that it makes and breaks contact with the stationary electrode to the left of E. The stem E projects outward somewhat from the flange C, in which the electrodes are mounted, and it carries on its end another finger, G, which also extends to the left. On this finger is mounted a flat strip or tongue, H, in such wise as to be pivoted at the left end of the finger and held loosely thereto by the bolt and nut 4, while its right end is still free to rise a little from the finger. A stud, G', passes through H, and the spring K holds the latter normally in contact with G. To the right end of H is screwed a block, M, of the form shown, and a spring, N, draws the latter, and with it the right end of H, downward.



In this position the contact finger of the inner end of E is out of contact with the stationary electrode. The rod P, which is guided by the tongues m and is held by the spring 8 in contact with the block M, is made to reciprocate up and down once during each cycle of the engine. When it rises it carries with it the tongue H, and thereby causes the inside contact finger to make contact. When contact is established, the tongue H continues to rise, compressing the spring K; and at the same time the lower end of the block M, moving into the position shown by the dotted lines, pushes the end of P to the right until H is released. The latter then snaps down, and, striking the finger G, carries it and the contact finger with it, producing the spark.

On its down stroke the push rod P snaps back into the position shown. The handle M', attached to M, affords means whereby the spark may be made to occur at any desired point, in starting the engine, and by making the length of P adjustable the lead of the spark may be regulated.

Four claims.

648,286—Motor Vehicle.—Albert H. Overman and J. H. Bullard, Springfield, Mass. April 24, 1900. Application filed July 28, 1899.

This is a steam carriage wherein all the operations of feeding water to the boiler, pumping up pressure in the air tank and controlling the flame of the burner to suit the pressure in the boiler, are made to take place automatically and without attention on the part of the operator, so long as water is supplied to the water tank and gasoline or other suitable fuel to the fuel tank.

The burner flame is controlled in the usual manner by a diaphragm regulator connected with the boiler pressure. Air is pumped into the fuel tank by a small independent steam pump controlled by a piston regulator in substantially the same fashion as the burner is by a diaphragm regulator, the piston regulator being in connection with the air pressure. Water is pumped into the boiler by a small independent steam pump, the steam supply to which is admitted or cut off by a thermostatic device arranged so as to be acted upon by the live steam from the boiler, or by a column of water in connection with the water in the boiler, according as the water level in the latter falls or rises; and provision is made whereby the said water column, although in connection with the boiler water

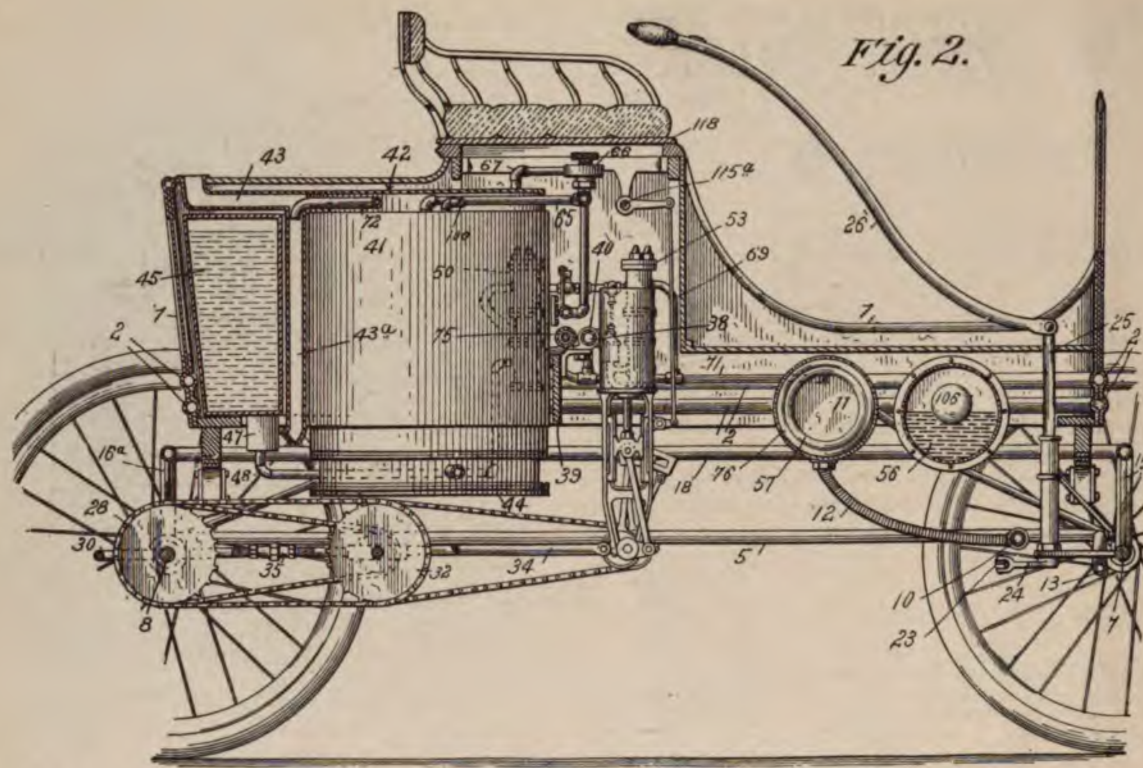


*Fig. 2.*

below and the live steam above, shall be cooled, before it acts on the thermostatic device, to a temperature below that of the live steam; the thermostatic device depending for its action on this difference in temperature between the water and the steam.

Fig. 2 shows the carriage in section, exhibiting the various parts of the mechanism. 41 is the boiler, 45 the water tank, 43 the flue for the escape of products of combustion, 44 the burner, 53 the engine, which swivels on a transverse tube 38, which is arranged to conduct the live steam to the engine and also to convey away the exhaust steam. 56 is the fuel tank, with a float 106 therein arranged in connection with a pointer outside the tank, so as to indicate the quantity of fuel in the tank. 11 is a heating drum, to be described more fully later on.

Fig. 5 is a section of the vehicle just forward of the fuel tank, looking forward, whereby the trussed construction of the frame is more clearly shown, the rear end being similar. Fig. 6 shows the frame in plan with the body removed. There is no fifth wheel, but the tubular members 55, 66 are not screwed up quite tight in the couplings 19, and a slight degree of flexibility is thereby imparted to the frame. The exhaust steam from the engine passes through the drum 11 (referred to later), and thence by the hose 12 to the tube 10, near the front end of the frame. Thence it follows the arrows (Fig. 6), emerging finally in a condensed state from the perforations 14 in the tube 13 just back of the front axle.

The sprocket on the crank shaft drives the intermediate sprockets 36, 31, 32, and one or the other of these latter drives the differential drum by the sprocket rings 27, 28, which are loose on the drum and connected thereto by a pin which passes through them and the drum parallel with the axle, and is long enough to enter one, but not both, of the sprocket rings. The sleeves 33, 33 are free to slip along the rods 34, 34, and in this way both sets of chains are tightened at once by adjusting the right and left hand nut 35.

*Fig. 5.*

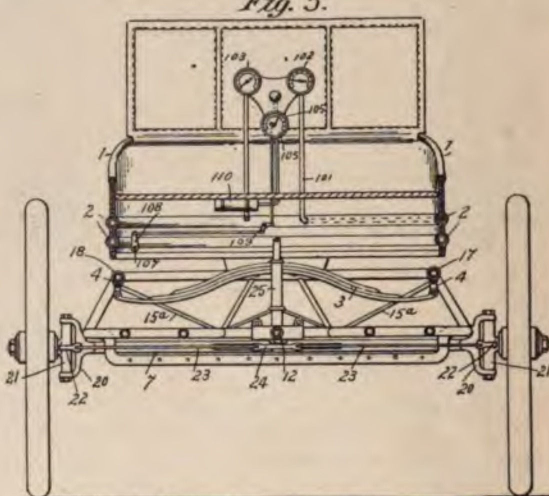


Fig. 7 is a perspective view of the boiler, fuel tank 56, heating drum 11, water pump 49, 50, air pump 53, 54, and practically all the circulatory system connected therewith. 114 is the regulator for the burner, of the usual type, and 98 is the glass water gauge, which is set in a recessed panel in the side of the vehicle. Live steam leaves the boiler by the pipe 65 and goes to the engine by way of the throttle 60 and pipe 59. Branch pipes 52 and 51 lead to the steam cylinders of the pumps, and the exhaust from the latter goes by way of the pipes 71 and 69 to the drum 11, where it is added to the exhaust from the engine. Besides the pipe 12, another pipe, 72, leads from the drum 11 to the top of the flue 43a (Fig. 2), and this may be used to propel the waste gases downward when a strong following wind prevents them from passing out by flue 43. The water from the tank, coming by pipe 48, leaves

Fig. 7.

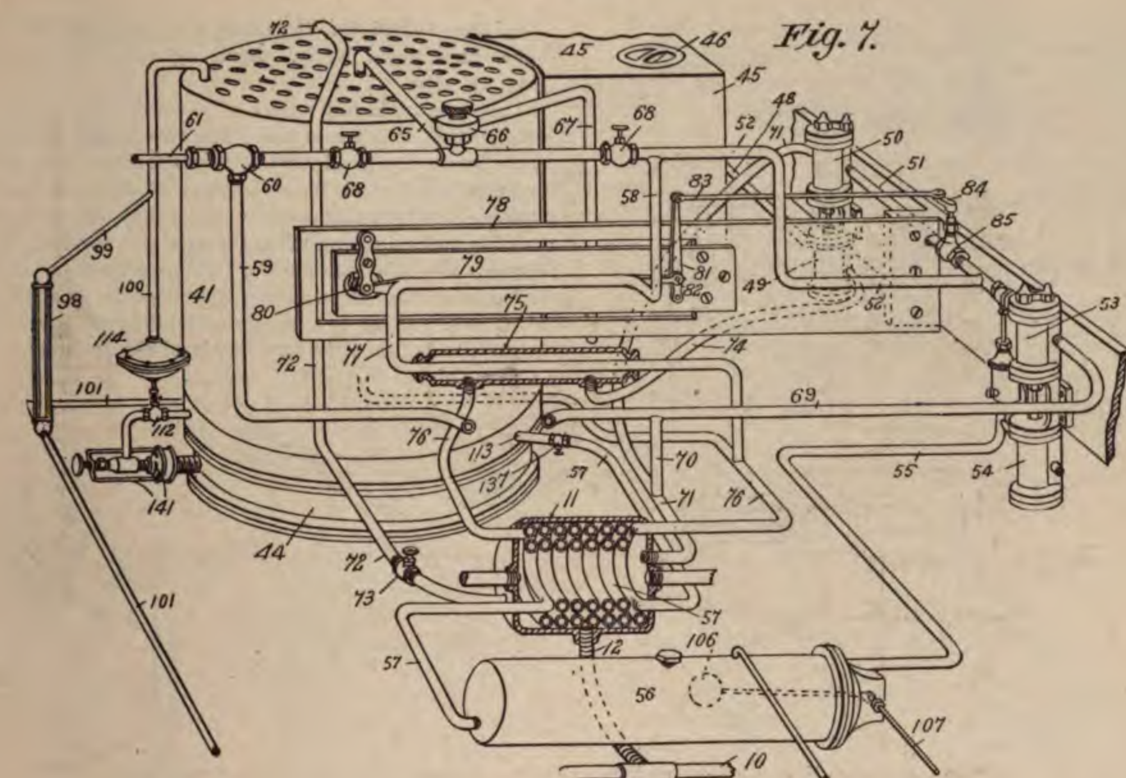
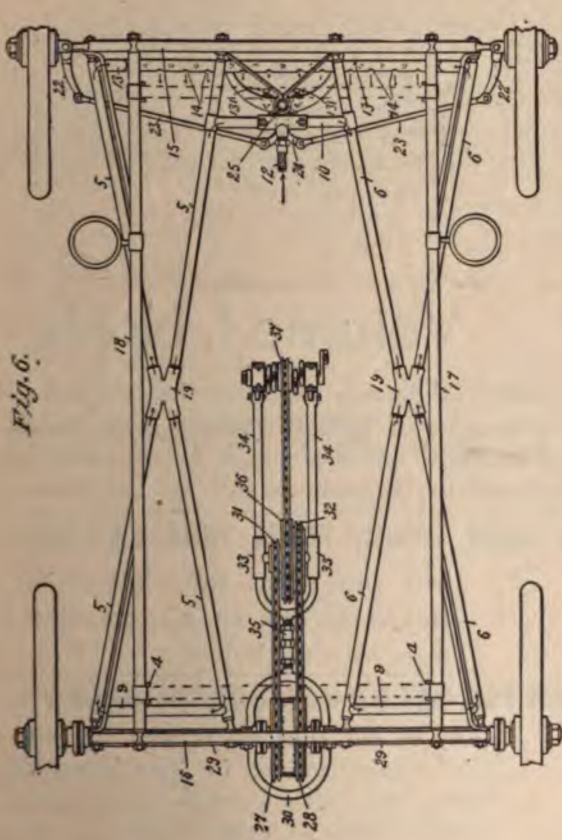


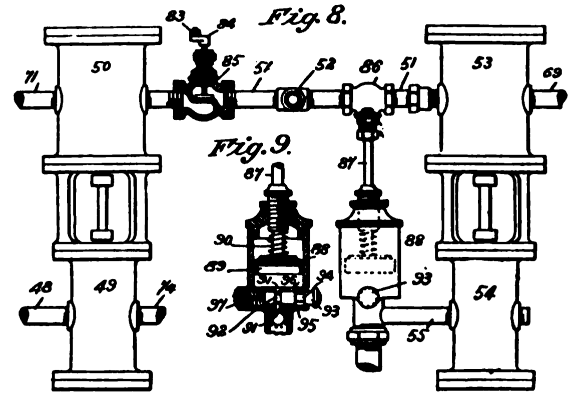
Fig. 6.

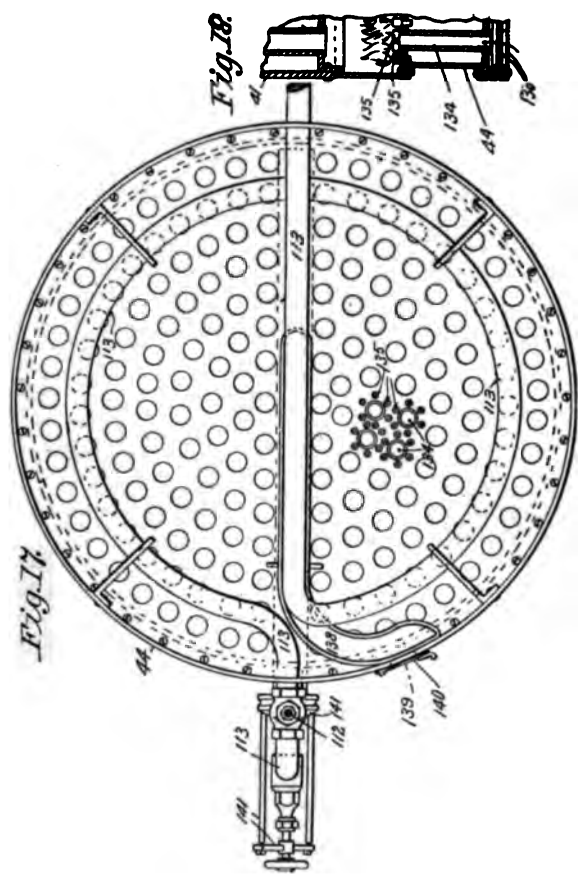


the water pump by pipe 74 and flows through the jacket 75. It then enters the drum 11 by the pipe 76, where it is heated by the exhaust steam, and enters the boiler by the pipe 76. A branch, 77, leads from 76 through the jacket 75, is made horizontal at 79, and connects at 58 with the live steam pipe 52. This horizontal portion 79 is slightly above the normal water level in the boiler, and is therefore normally filled with live steam. When, however, the water level rises, by reason of the continued action of the pump, water enters 79 from the pipe 77, and this water, from its passing through the jacket 75, is colder than the steam, and causes 79 to contract. Now, the left-hand end (in the figure) of 79 is secured at 80 to a fixed point, and the right-hand end is connected to a lever, 81, which closes the valve 85 in the steam pipe 51 when 79 contracts. In order to insure that the point 80 shall be absolutely fixed with reference to the valve 85, it is pivotally supported as shown on two metal plates having different coefficients of expansion, so that the less expansion of the longer plate 78 is counterbalanced by the greater expansion of the shorter one.

The steam supply of the air pump is controlled as shown in Figs. 8 and 9, the space below the plunger 89 being in communication with the air pressure, and the valve 86 closing when the plunger rises against the pressure of the spring 90. The valve 93 is provided so that a higher pressure may be obtained when desired, as, for example, in order to pump up the tires. It operates, when pressed inward, by closing communication between the air cylinder and the space below the plunger 89, and at the same time opening the vents 96, 95 so that the plunger returns to the lower end of its travel.

The fuel from the tank traverses the inner coil of tubes 57 in the drum 11, and receives a preliminary heating before it enters the burner at 113. As shown in Fig. 17, it then passes through the coil 113 and emerges in the form of vapor on the




opposite side, where it passes through the valve 112 and the air mixer 141 and then enters the base of the burner 44. Gauge plates 130 prevent drafts from disturbing the air supply, and from them the air passes up through the holes 134 to supply the flames. A trough, 138, is provided, which may be filled with alcohol through the door 139, to start the vaporization.

Twenty-five claims.

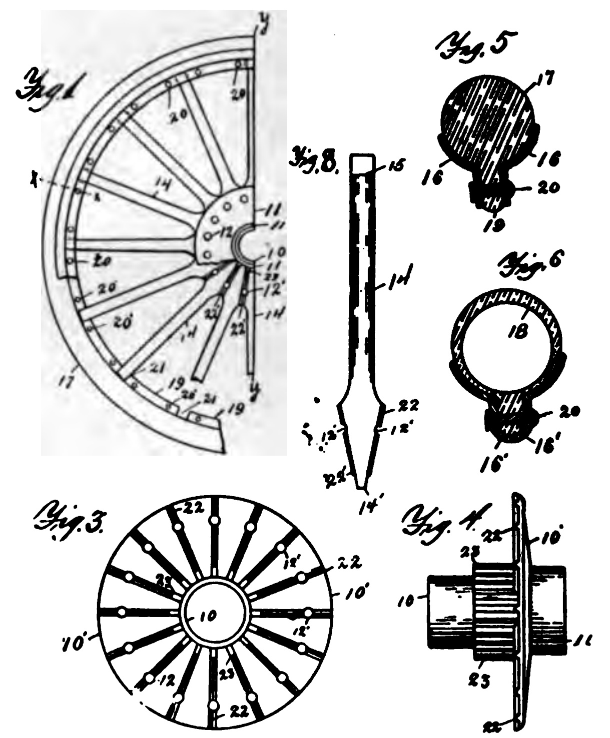
648,537—Vehicle Tire.—John G. Sorup, Tiffin, O. May 1, 1900. Application filed March 26, 1900.

648,635—Vehicle Tire.—Frank A. Seiberling, Akron, O. May 1, 1900. Application filed Jan. 11, 1900.

648,087—Wheel for Horseless Carriages.—Clark W. Salisbury, Jamestown, N. Y. April 24, 1900. Application filed Aug. 23, 1899.

This is a metal hub wheel with wood spokes and a special construction of rim and tire. The two flanges of the hub are made with V-shaped radial projections 22 on their inner faces, which fit the beveled edges of the hub ends of the spokes, by which construction the spokes are prevented from twisting and collapsing when the axle is in torsion. Bolts pass through the holes 12' and are tightened by nuts. The rim is rolled from sheet metal in two halves, as shown at 16, 16, or as at 16', 16', and the tire has tongues filling the spaces thus left in the rim between the outer ends of the spokes.

Two claims.



## BRITISH PATENTS.

No. 1,709 of 1900—Motor Vehicle.—F. Strickland, Putney, London, England.

This invention relates to a method of arranging the motor and driving gear of vehicles. The arrangement is shown in Figs. 1, 2 and 3. Referring to these, A is a continuous axle for the vehicle wheels, and is mounted in suitable bearings disposed at each end of an inclosing tubular casing, B. Upon this axle and its casing is mounted the entire driving mechanism and motor, and the casing B supports the vehicle in the usual manner. C is the motor, inclosed and suspended upon the axle casing B by a clamp, D. The motor shaft $C^1$ transmits its power through the medium of variable speed gear K and pinion F, the latter driving an internally toothed gear wheel G, which transmits motion to the shaft A and vehicle wheel $A^1$, through differential gear H. This differential gear H and the driving gear wheel G are disposed as shown, and the wheel G is mounted centrally between the bevel wheels $H^1$ $H^2$ of the gear H and drives the latter by bevel pinions $H^2$ $H^3$. The bevel wheel $H^1$ next the bearing is keyed to and drives the axle A and vehicle wheel $A^1$, while the outside bevel wheel $H^2$ drives the vehicle wheel $A^2$, which is free upon the axle A. The gear wheel G is, as described, geared internally with pinion F, and its outside face is recessed and provided with a flat surface, J, as shown, to receive a band brake. The variable speed gear K may be of any suitable kind. The form shown is one in which two speeds are provided for, and it consists of friction clutches $K^1$ $K^2$, of usual construction, mounted upon a shaft, M, in line with the motor shaft $C^1$ and carrying gear wheels, $K^3$ $K^4$, gearing with wheels, $L^1$ $L^2$, of different sizes on a side shaft, L. The sliding parts $K^5$ $K^6$ of the clutch K are keyed by a feather to their shaft M, which carries the pinion F, and the variation of speed is obtained by shifting one or other of the sliding parts $K^5$ and $K^6$ into gear, this being effected by a suitable vibrating lever N engaging a sleeve, $N^1$, between which and the parts $K^5$ $K^6$ ball bearings, $N^2$, are provided. The shafts L and M are carried at one end in bearings upon the motor casing as at O, and at the other end in a frame, $O^1$, fixed to the casing B.—The Mechanical Engineer.

From Messrs. Phillips, Ormonde & Co., patent and trade mark agents, 533 Collins St., Melbourne, Victoria, the following particulars have been received of motor vehicle patent applications in Australasia. Should any further details be required we are authorized to state that Messrs. Phillips, Ormonde & Co. are in possession of all information that may be wanted:

Balanced Rotary Steam Engines.—E. Waters, Jr., Melbourne (communicated by B. Ljungström, of 18 Grefmagnigatan, Stockholm, Sweden). No. 17,002. In the Colony of Victoria.

Brakes of Light Vehicles.—J. H. C. Vroland, of Strathbogie, Victoria. No. 17,018. In the Colony of Victoria.

Automatic Pump for Pneumatic Tired Wheels.—H. H. Henning, of 14 Q. D. Bank Chambers, Adelaide St., Brisbane, Queensland. No. 17,019. In the Colony of Victoria.

A Detachable Pneumatic Cushion for Saddles.—W. Terry, of "Verulan," Mount Albert Rd., Balwyn, Victoria, and A. Golding, of "The Pines," Balwyn Rd., Canterbury, Victoria. No. 17,026. In the Colony of Victoria.

An Automobile.—W. P. Kidder, of 18 Robeson St., Boston, in the County of Suffolk, State of Massachusetts, U. S. A. No. 17,033. In the Colony of Victoria.

Manufacture of Waterproof Fabrics and Spreading Machines Applicable for Coating or Proofing Rubber Proofed Fabrics.—L. Frankenstein and C. Lyst, both of Victoria Rubber Works, Newton Heath, Manchester, in the County of Lancaster, England. No. 17,036. In the Colony of Victoria.

Devices for Attaching Rubber Tires to Vehicle Wheels.—P. A. Staley, attorney of the Rubber Tire Wheel Co., of Sheridon Ave., Springfield, in the County of Clark and State of Ohio, U. S. A. (assignee of A. W. Grant, of Springfield, aforesaid). No. 17,040. In the Colony of Victoria.

Tires for Bicycles or any Description of Vehicles.—Frederick Jones, of 4 Home St., Wellington, New Zealand. No. 12,443. In the Colony of New Zealand.

Automatically Coupling and Uncoupling Railway Carriages, Wagons and Other Vehicles.—Darling's Patent Automatic Coupling Co., Ltd., having its registered office at 79 W. Regent St., Glasgow, Scotland (assignee of John Darling, of 2 Wharton St., Kingcross Rd., London, England, and John Darling, Jr., of Gallowflats, Rutherglen, Lanark, Scotland). No. 12,389. In the Colony of New Zealand.

FIG. I.

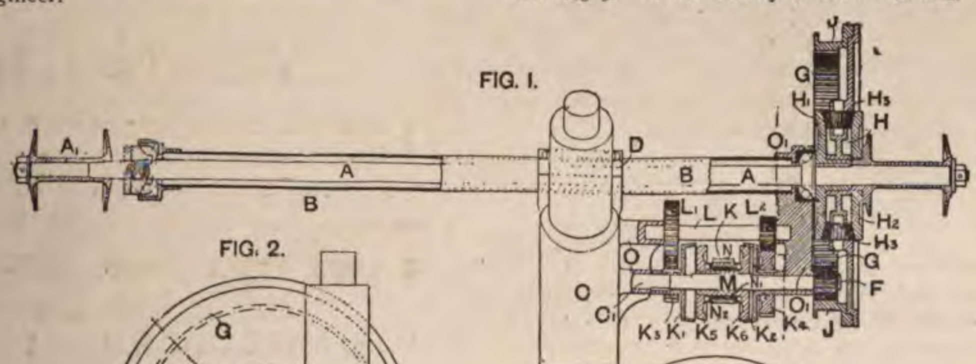


FIG. 2.

FIG. 3.

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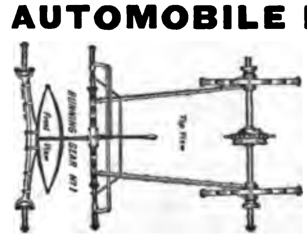

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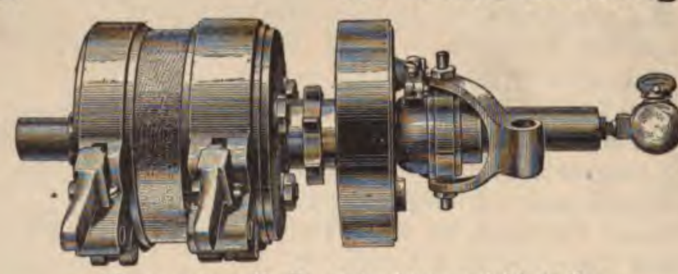

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THE shaft is continuous, and may be driven direct from the motor shaft. The left-hand brake operates the reverse, which is at slow speed. The brake next to it operates the slow speed ahead. The sprocket wheel drives the axle. The friction clutch at the right locks the whole system and drives it at the speed of the shaft. A pinion may be used instead of sprocket if desired. Lubrication by oiler on the end of the shaft. . . . . .

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# THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. VI. NEW YORK, MAY 23, 1900. No. 8.



THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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**On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.**


The Acetylene Motor Number will appear June 20.

## Patents and the Public.

Without doubt our correspondent in another column, who deplores the multiplicity of obstructive patents on motor vehicles, and seeks information as to the direction in which he will find these least numerous, voices the thought and wishes of a substantial contingent among our readers. It is certainly very tantalizing to the experimental builder of a carriage, when he has made up his mind as to just what will fill the bill in a given place, to find that some other fellow has hit on the same thing before him and has secured to himself the exclusive right to use it. If, as is not unlikely, the late comer has spent some time and perhaps money in developing the idea, before he finds that he has been anticipated, his disposition to regard the letters patent guarding it as a hindrance to free invention is at least natural.

The trouble is, however, that in most cases this same experimenter no sooner evolves an idea which is genuinely original than he hies him to the Patent Office and fortifies his title to it with every fence and barrier which the ingenuity of himself and his lawyer can erect. He has been hampered by other men's patents, but he is not at all averse to taking out a patent himself, and in fact is likely to regard it as no more than his just due in compensation for the labor he has undergone. This being the case, he can hardly complain. If he has started late he has at least the benefit, if he chooses to avail himself of it, of his predecessors' experience, and he is not assuming risks commensurate with theirs. He has possibly less opportunity for a financial "strike," but he is certainly not staking his all on one cast of the die.

Inventions of the sort under discussion may be of two classes: They may be practical, in which case they are probably put to use as soon as patented, or before, and their patents serve an effective purpose; or they may be impractical, in which case the patents on them serve no other end than to keep others from attempting the same thing. If the impracticality is fundamental, the patent is really a public benefit. If, however, the invention is impractical only in its details and embodies a really useful principle—a thing which often happens—either the subsequent inventor must modify the details so as to use the principle while avoiding the patent, or he must perforce make terms with the patentee. As in its then existing form the patent is probably worthless, this should not ordinarily be difficult. Either the patent can be purchased outright, or, by patenting a necessary improvement on it, one or the other patentee can operate both patents under license. In the case of a patented invention originally designed for another purpose, its use in modified form for a service other than at first intended will not injure the patentee, and an exclusive license for such use will in that case amount in effect to a separate patent.

The idea that patents are in the nature of class legislation, for the benefit of the few at the expense of the many, is more common among consumers than it is among inventors, even when those inventors find themselves forestalled by others.

By whomsoever held, it is in the main fallacious. Inventions do not grow on bushes, perfected and ready for commerce. Most of them cost a large amount of time, study and money. If as soon as they were perfected some one else could step in, and with a tithe of that initial outlay produce the same article in competition, inventors would hesitate longer than they do before shaking dice with the goddess Fortuna. The consumer who complains of the royalties he pays would in all reasonable likelihood not be using the product in question at all were it not for those royalties.

On the same grounds are to be justified the patents on alternative forms, when inventors select the best form for a given device and then patent related but inferior forms to shut out competition. Aside from these, however, it is not obvious how the large class of patents on impractical or unworked devices is to be defended, otherwise than on the ground that it is an unavoidable concomitant to the working of the system. It is not in accord with abstract justice that the inventor of a useful device should have to pay money to the inventor of a useless device, merely because the latter "got there" first; but, while it works hardship in individual cases, it is not probable that any large public interest is thereby sacrificed, and we have not heard of any feasible proposition for doing away with that feature while retaining the system. To require that a patent be worked or annulled, as is done in some countries, would seem to have nearly as many possibilities of injustice as the other plan, and to invite evasion besides.

We imagine that the class chiefly interested in the question raised by one correspondent will be those who are constructing vehicles, not for future gain, but for their own private use and satisfaction. Those who are inventing and building for the market must conform to the rules of the game; but the amateur has most often no wish to precede his work by an investigation of patents. If he is aiming at novelty he had much better do so; but if he wishes only to produce something that will go, and to tempt Fate with novelties as little as possible, he is likely to think the motor vehicle a difficult field. The main trouble is that it is so recent, and very few useful patents on it have yet lapsed. Wagons and motors and differential gears are not new, but the combination of these in a self-propelling entity calls for invention, and most of the inventive ideas which have been spent on it thus far are still private property. In stationary and marine gas engines, in electric motors and storage batteries, and in steam engines of almost any sort, the individual builder has a reasonably unfenced field, but in motor vehicles he has a real problem, and we hope that any of our readers who have had experience in this line will contribute it for the benefit of their fellow workers.



## Not Fool-Proof.

Two stories, which may or may not be true, have lately appeared in the papers about electric cabs which started with their passengers, ladies in each case, and could not be stopped till the batteries had "run out." One was in the high speed and carried its victims out into the remotest suburbs of Boston, whence they sadly returned by the steam cars. The other was running more slowly, and as it was evening the driver was able to go round and round the block, the machine finally stopping within a door or two of his "fare's" destination, which she entered—being bidden there to a dinner—just as the other guests were leaving the table.

We confess to entertaining some doubt as to the authenticity of these tales, though neither is intrinsically impossible. Two others have appeared, however, concerning mishaps to vehicles not electric, the reasonableness of which is mournfully evident. In one case a steam carriage balked and its driver, thinking the burner flame had blown out, applied a match. An explosion followed, and the machine "took fire" and was somewhat damaged before the flames were extinguished. In the other case a steam carriage had just been housed, apparently all being well, when without warning the gasoline tank blew up and instantly caught fire. The conflagration was quickly subdued, when it was found that a leak had occurred near the tank, and the gasoline, taking fire, had heated the tank till the latter blew up from the pressure of the vapor within.

The former of these accidents may be trusted to point its own moral. If the flame under a boiler is blown out, either it must be relighted at once or the gasoline must be shut off till the operator gets ready to apply the match. Otherwise the inevitable will happen. The moral of the second mishap is the one pointed out by our correspondent "Steam Carriage" not long ago, namely, that all glands, couplings and pipe fittings about a steam vehicle must be made tight and kept tight. There is nothing impossible about this, and the need of it is much more imperative than in carriages with explosion motors, where a leakage simply wastes gasoline without jeopardizing the vehicle's occupants.

## Perfection Near at Hand.

It is with a feeling of decorous elation that we invite our readers' attention to the invention, shown in another column, which supplies the last great need of the motor vehicle. Builders and users alike have long felt that the one bar to the instant and universal popularity of the new locomotion has been the crude, "sawed-off" appearance of the machines that have been foisted on the public. But, as often happens, the most obvious remedy has been the one to be overlooked; and

not until the bright genius of Emile Langrenne discerned that the true reconciliation of the æsthetic and the mechanical lay in the addition of a mechanical horse, with the motive power placed inside of it, has the problem evoked any solutions worthy of the name. The day of the "horseless" carriage is done. It only remains to improve the auto-motor horse so that it will automatically run away when it meets automobiles of the Philistine sort, and balk and kick out the dashboard when given too much work to do. The twentieth century motor will then be a perfected thing.

## Baltimore Parks Barred.

The Park Board of Baltimore has made a rule excluding steam and gasoline vehicles from the parks of that city on account of the supposed greater liability of these vehicles to frighten horses. Electric carriages are admitted as before. The new regulation has aroused the hostility of the owners of motor carriages thus discriminated against, and there is talk of legal resistance to it. M. Gillet Gill, a well-known business man of Baltimore, who is the owner of three steam vehicles, said in a recent interview:

According to the record kept by my cyclometer I have traveled 3,000 miles in my steam carriage. I estimate that I have passed 20 carriages in every mile of that travel. Probably six out of every hundred horses that pass an automobile will prick up their ears, about four will shy at the horseless carriage and one out of the hundred will prance and shy off at the side. Of course, as horses become more accustomed to the automobiles the liability of their becoming frightened is that much lessened. I have not yet caused a runaway, and I have observed that thoroughbred horses have shown less fear than those of commoner breed.

The matter has excited some comment, and a writer to the Baltimore Sun has the following to say about it:

I think there are not very many automobiles in Baltimore, but they have many friends, and the few horse owners who have fractious horses, that they acknowledge they cannot control, will find out that the park does not belong to them alone, and that others have some right to be there. I believe a horse that will run away at the sight of an "auto" is a dangerous animal, likely to cause great damage to life and property, and should not be allowed in the park. This is where the shoe pinches, and the people who are now making the kick against motors are owners of horses which they cannot control.

I trust that the Park Board, in the near future, will modify this new rule, as it strikes me that it is discriminating in favor of the fractious horse. I am not the lucky owner of either a horse or a motor carriage, but like to see fair play. We can all remember that it was only a few years ago that horses were more frightened at bicycles and electric cars than they are now at the motor carriages.

## Helping the Beginner.

In view of the tendency of automobiles to run into stone fences, we suggest to the Reading builders of those contrivances that they add a fence-jumping attachment to their latest models. It should be arranged so that by pressing a button the machine would instantly leap over a fence instead of bumping into it. The sudden stop against a fence is apt to jar one. A plunge into a hay stack or a ploughed field would be much easier.—Reading (Pa.) Telegram.

## The Construction of a Jump Spark Coil.

By E. J. Stoddard.

INTRODUCTORY ARTICLE.

The Ruhmkorff coil has been made for the laboratory and lecture room, and its construction has been the exercise and the pride of the scientific dilettante. We find much curious and wonderful lore as to its performance and the mode of operation of its parts, but no complete, practical working theory.

I propose to describe the making of a conventional coil that may be used to ignite the charge in a gas engine. It is not the best form. That rests in speculation, though the way is clearly blazed to its adaptation to practical purposes. But the construction I shall describe will answer the purpose, if carefully made and cared for. One should continually keep in mind that he is to exercise minute care in every particular, and that cleanliness is important.

When we come to wind on the wire of the secondary coil, we shall want to test each layer, not only to find whether or not the circuit is continuous, but also to discover any defective joint that may be present. We shall therefore require a measuring instrument adapted to this purpose. I have found a sine galvanometer useful for this, as well as for quite a number of other purposes. I will therefore describe an instrument of this kind which is quite easy to make and which I have found efficient.

Fig. 1 is a perspective view of such a galvanometer; Fig. 2 is a section through the needle box and base; Fig. 3 is a top plan view of the base; Fig. 4 is a bottom plan, and Fig. 5 a side elevation of the needle-carrying disk, and Fig. 6 shows the galvanometer connected with a graduated resistance board.

A is a base board 10 or 12 in. square, having a circular depression B (Figs. 2 and 3) at its center, and extending about half way through C is a circular board, or disk, a little less in diameter than the width of the base board. At the base of the board C is a small circular projection c, adapted to fit into the depression B in the base board A. The boards A and C may be readily formed on the speed lathe by any one having even a small degree of facility in turning.

D is a narrow box extending diametrically across the board C. This box may be an inch broad, and consists of the two sides and ends, with the disk C forming its bottom, and is adapted at its upper edges to receive a glass plate which forms its cover.

The magnetic needle will be placed in this box, and be shielded thereby from drafts of air, while the position of the needle may be observed through the glass cover. Before securing the box frame upon the board C, a dozen turns of fine insulated wire, g, are wound around it longitudinally over and under. No. 30 German silver wire may be used.

E is a sewing needle driven vertically upward through the center of the board C, and extending toward the top of the box D inside the said box. F is a piece of steel bowed up at its center, as at f, and inclining from its center slightly downward to each end. The temper may be drawn to shape the steel, and the piece then heated to a red heat and dropped into water to restore the temper. Now hold one end of the piece of steel F upon a pole of a dynamo, and then balance it upon

the point of the needle E, and we have a magnetic needle. It may be balanced by weighting it with pieces of wax.

The ends of the wire forming the coils g are secured to binding posts h h, on the board C.

A semicircle upon the base board A, at the edge of the board C, should be graduated into spaces corresponding to say 5 degrees each, and a piece of metal, i, may be secured in place to serve as a pointer.

Having constructed this simple device, we have a delicate and efficient galvanometer.

It is operated in the following way:

The base board is turned until the needle, pointing northward, comes to rest along the center of the box D, and directly in line with the upper turns of the coil g, with the pointer i at the zero of the scale. The current to be measured is then sent through the coil g by making connection with the binding posts h h. The needle F immediately turns upon its pivot and strikes against the side of the box. The board, or disk, C is now turned until the magnetic needle F is again at rest along the center of the box D. The current passing is proportional to the sine of the angle indicated by the pointer i.

The following is a table of sines from 0 to 90 degrees, advancing by 5 degrees. Intermediate values may be interpolated by simple proportion:

| Angle. | Sine. | Angle. | Sine. |
|---|---|---|---|
| 0 | .0 | 50 | .766 |
| 5 | .872 | 55 | .8192 |
| 10 | .1763 | 60 | .866 |
| 15 | .2588 | 65 | .9063 |
| 20 | .342 | 70 | .9397 |
| 25 | .4226 | 75 | .9659 |
| 30 | .5 | 80 | .9848 |
| 35 | .5736 | 85 | .9962 |
| 40 | .6428 | 90 | 1.0000 |
| 45 | .7071 | | |

The above described arrangement is suitable only for very small currents and it gives only the relative values: which, however, is sufficient for testing the secondary wire of a sparking coil. For such purposes as testing batteries, measuring their internal resistance, the current they will give out, etc., we may construct a graduated resistance board like that shown at G, Fig. 6. This consists of a number of binding posts, j, arranged in pairs, the posts of each pair being placed perhaps 1 ft. apart. Wires, k, k, of varying diameters extend between each pair of posts j. One of the wires, k, is interposed in the circuit, the current of which is to be measured, and the coil of the galvanometer is connected to the binding posts at its end so as to form a shunt circuit, as shown in Fig. 6. A current is now

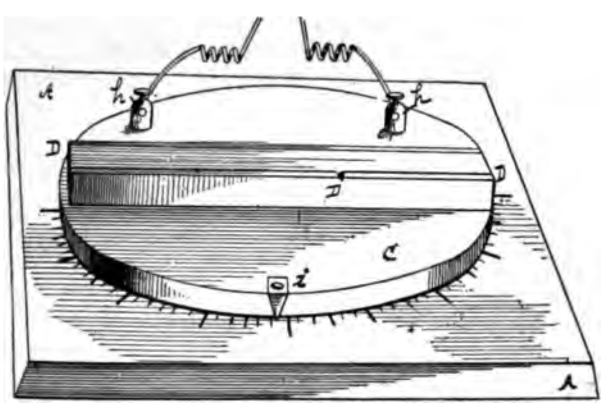


FIG. 1.

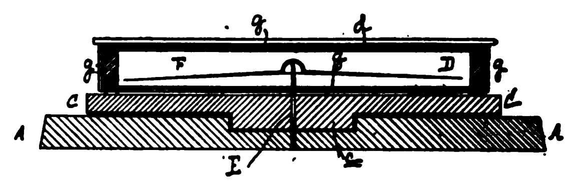


FIG. 2.

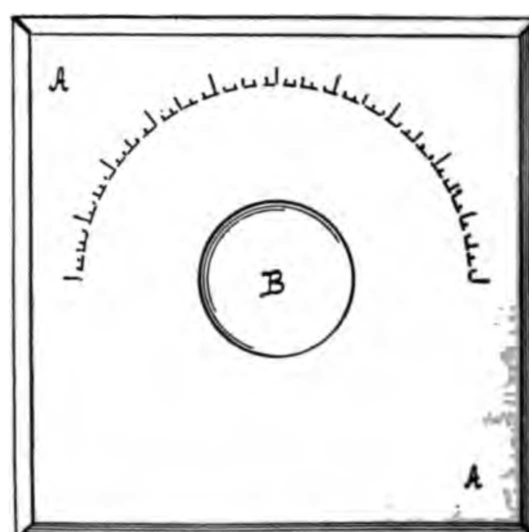



FIG. 3.

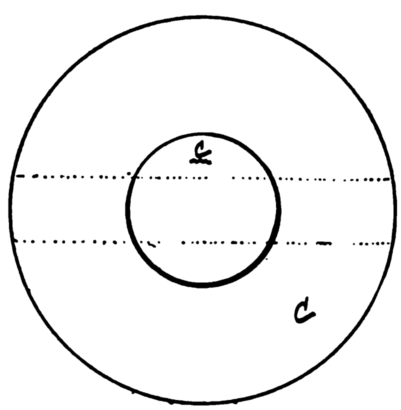


FIG. 4.

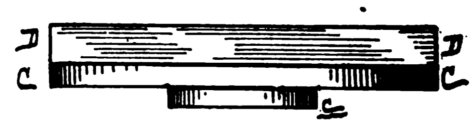


FIG. 5.

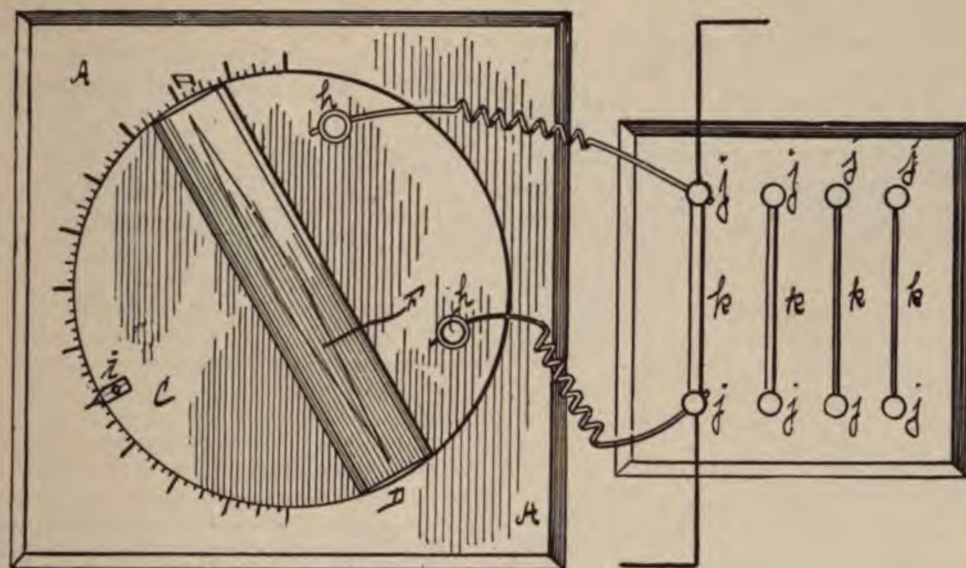


Fig. 6.

sent through the main circuit, in which is placed a standard ammeter, and the corresponding deflection of the galvanometer noted, and recorded upon the base board under the wire k used. Having got one reading in this way the ammeter may be dispensed with and the current measured by the galvanometer. Each of the wires k is standardized in the same way. In this manner we may construct a reliable instrument that may be read for currents ranging from a small fraction of an ampere to perhaps 100 amperes.

For measuring the internal resistance of batteries one would need a standard resistance of perhaps half an ohm. For this purpose he might use a German silver wire, No. 20 B. & S., 3 ft. 7 in. long, and call its resistance half an ohm until he could compare it with some standard resistance.

In the next article I shall take up the practical construction of the coil.

THE RAOUVAL VOITURE.

## The Raouval Voiture.

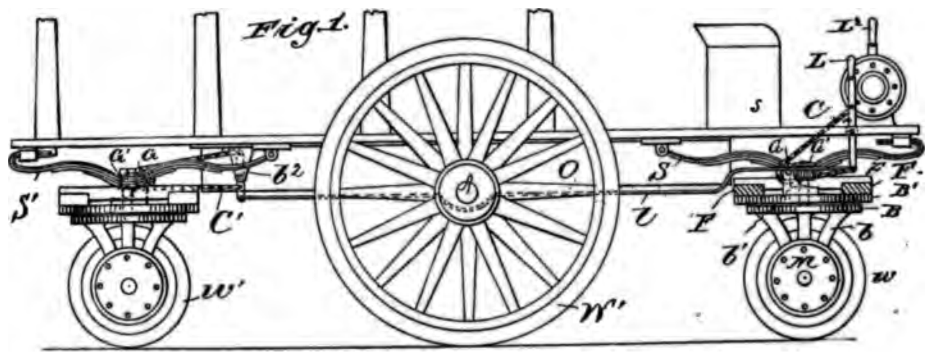
In the Explosive Motor Number, page 50, were given the data of a test of an 8-h.p. Raouval voiture, and we show herewith a photograph of it. It will be seen that, as usual in the French vehicles, the springs are interposed between the axles and the frame. The design suggests that touring rather than racing is intended.

## Wasted Ingenuity.

By H. L. T.

A patent on an "automobile truck," issued not long ago, impresses one as combining in more than ordinary degree the elements of what should not be done in the matter of running gear. The inventor sets forth the purpose of his invention as directed especially to "the arrangement of devices by which I attain ease in steering the vehicle." The truck in question is electrically propelled, and the benefits to be derived from a successful device to lighten the labor of deflecting the heavily loaded steering wheels will at once be admitted, since one of the restrictions on the speed of such trucks is in the fact that the ordinary reducing gears between the hand wheel and the steering axle take so long to operate. The inventor, knowing this, points out very truthfully that "to turn a single wheel, especially if there be no great weight upon it, is much easier than to turn two wheels at opposite ends of a single rigid axle"; and this principle is the one utilized in his invention.

The general arrangement is evident from the drawing. Its leading feature consists in the use of two large wheels on an axle under the middle of the body, which wheels carry the major part of the weight of the truck, while steering is effected by two small wheels under the body and in the center line of the truck, one being a "leader" and the other a "trailer," and both being pivoted so as to swivel




about vertical axes. The remarkable feature of the arrangement is that these small steering wheels, which are expressly stated to be loaded as lightly as possible, are the driving wheels as well, and the large wheels amidships are free on their axles like any ordinary truck wheels, and serve merely to take the weight off the drivers. As any one can see, the small wheels would not be a success if heavily loaded, but it is not at all clear how they are to pull the thing around unless they are heavily loaded. The invention specifies a pair of motors on each steering wheel, one on each side of the forks, and of course the front and rear wheels are independent. This being the case, it does not take a great effort of imagination to picture one end of the truck as sagging under a badly trimmed cargo, and the wheel at the other end spinning around and scattering dirt and stones in its futile effort to grip solid ground. It is a reasonably safe guess that before this truck, if it is ever built, has run very long, the four small motors on the steering wheels will be discarded in favor of one or two large ones geared to drive the middle wheels.

But if the inventor showed himself somewhat at fault in the matter of the driving wheels, he achieved no better success with his steering gear. No requirement of motor vehicle design is—or ought to be—better known than that when the vehicle is following a curved path the lines prolonging the axes of all the wheels must either intersect in a point or pass through the same vertical line. If the wheels are of the same size and swivel on vertical studs, they will do the former; otherwise they will do the latter. But our inventor provides a separate lever for swiveling each wheel, and proposes under ordinary conditions to turn the front one alone, innocently adding that "at the same time, if he desires," the driver may turn the other one to "assist" in directing his course.

Precipitancy of this sort, in applying for patents before the inventor knows whether his ideas are good or worthless, benefits no one but the patent attorney. The inventor with an idea, however, is a notoriously intractable subject, and if the idea is worthless he may be considered as having fulfilled his earthly mission when his fate is made a warning and an example to his fellows.

## The French Automobile Annual.

The 1900 edition of the "Annuaire Général de l'Automobile" is announced by its editors, F. Thévin and Ch. Houry, 21 Rue du Louvre, Paris. It is a handy volume, containing a large amount of information useful to the automobilist, in the way of names and addresses of builders and dealers, of liveries, charging stations, repair shops, automobile clubs, trade publications, taxes, etc. A previous edition, which we have by us, has the four leading divisions of builders, dealers, local and miscellaneous information, printed on paper of different colors, thus facilitating reference. The previous editions have confined themselves to the European countries, but this year's issue will contain information gathered from the United States also. There are numerous advertising pages sprinkled through the book, and a peculiar and perhaps not wholly meritorious feature is the printing of some of these on cardboard, so that the book naturally opens at those pages. The price, 10 francs ($2), is moderate.

## Steam Consumption in a Small Motor.

In view of the employment of small steam motors for automobile purposes, the following particulars of some trials made in order to determine the steam consumption of a small motor will be of interest. The motor in question was manufactured by W. D. Forbes & Co., of Hoboken, N. J., under specifications of Col. E. A. Stevens. It is one of the piston-valve type, 5 in. x 5 in., single-acting, automatic cut-off engines, especially adaptable for torpedo-boat service on account of its comparative lightness. The engine weighs about 440 lbs.

The tests were made in connection with a surface condenser and the condensed steam run into barrels and weighed. A prony brake was used to measure the tangential pull on the fly wheel.

The governor, invented by F. W. Rites, is of such a construction that it acts by centrifugal force, the inertia of its reciprocating parts and the rotary inertia itself. The control which this mechanism exerts over the engine is so perfect that the greatest variation in speed, after its spring has once been set, is not more than 1.5 per cent.

| | TEST NUMBER. | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Pressure at Steam Chest, pounds per square inch above atmosphere.... | 80. | 80. | 80. | 80. | 100. | 100. |
| Revolutions per minute.... .... | 446.0 | 442.5 | 610.0 | 622.0 | 605.8 | 609.3 |
| Mean Effective Pressure, pounds per square inch. ........ ..... | 35.51 | 54.04 | 35.42 | 48.75 | 54.19 | 60.53 |
| Indicated Horse-Power=I.H.P..... | 7.732 | 11 674 | 10.548 | 14.803 | 16.097 | 18.005 |
| Brake Horse-Power=B.H.P........ | 6.250 | 10.281 | 9.883 | 14.179 | 14.951 | 16.760 |
| Total Consumption, pounds water per hour..... ................ | 378. | 504. | 502. | 663.0 | 672.0 | 752.0 |
| Total Water Consumption in pounds per hour per I.H.P. .. ......... | 48.89 | 43.18 | 47.59 | 44.11 | 41.93 | 41.76 |
| Total Water Consumption in pounds per hour per B.H.P............... | 60.48 | 49.01 | 50.79 | 46.76 | 44.94 | 44.87 |

## COMMUNICATIONS.

### Patents Not Wanted.

Ozone Park, L. I., May 15.

Editor Horseless Age:

It seems to me that a most timely subject for The Horseless Age or some of its able correspondents would be to define the status of the horseless vehicle, as relates to the various forms of vehicles' general principles involved, and what lines would be safe to enter upon in the construction of a vehicle for individual and general use—one which would not be hedged in by the thousand and one patents, many of which are of no practical value and serve no other purpose but to gratify the vanity of some would-be inventor or to frighten off some timid inventor or investor. Now, to my mind, the horseless vehicle will never prove the popular success which it ought to be until it can be thrown open to competitive trade, like any other manufacturing business, without being hedged in by the innumerable patents with which it is being surrounded. At present the horseless vehicle is entirely beyond the reach of even the fairly well-to-do masses, many of whom would be glad to own them, and to whom they would become a source of income as well as pleasure. I have mentioned no one kind in particular, but I believe the coming one will be steam, as being the most practical in its simplicity and ease of management as well as from the ease of obtaining the necessary elements for its operation, besides being less hedged about by obstructive patents.

A. S. MUNGER.

### The Two-Cycle Engine Again.

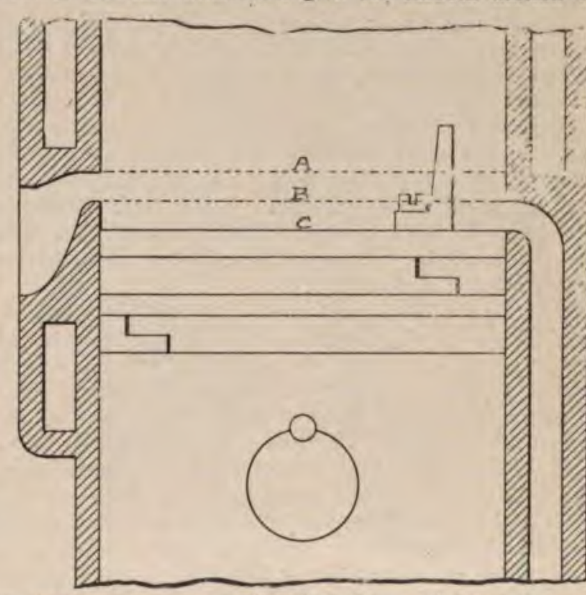
Buffalo, N. Y., May 17.

Editor Horseless Age:

In your April 25 issue there is an article by C. P. Malcolm in defense of the two-cycle motor. The writer, having manufactured during the last five years a considerable number of two-cycle motors, also wishes to defend them. From his experience in marketing these, he is sure the two-cycle motor has a good field of its own outside of vehicle propulsion, for which it is not well adapted.

Mr. Malcolm writes that at present they are not at liberty to publish all the data in connection with their two-cycle motor. Are we to take this to mean that they have not completed all their experiments? If this is the case, it will be interesting when he gets everything completed to know just how many impulses per minute Mr. Malcolm can get from a simple two-cycle motor, not provided with extra working air pumps, which would make a more complicated motor than a four-cycle. He speaks of 1,200 to 1,500 revolutions per minute being easier for the working parts of the two-cycle motor than on the four-cycle. While this is probably so, I should think he is to be very much congratulated if he succeeds in running much above 600 revolutions per minute without skipping impulses.

Mr. Malcolm states that in his 4-in. stroke two-cycle motor he opens his exhaust at ½ in. before end of stroke and does not think he loses much of the rotative effect (our two-cycle motor opens ⅝ in. early). If this is allowable on the two-cycle motor it holds good on the four-cycle, and we have all the extra time due to the conversion of a reciprocating to a rotary motion, as claimed by Mr. Malcolm, with the further advantage of being able to keep our valve open for the complete return stroke. Let us see what takes place in a two-cycle motor when the piston uncovers the ports. Suppose everything is tight (referring to sketch) and the terminal pressure at A is 40 lbs. When piston arrives at B the pressures in the cylinder and exhaust pipe have equalized themselves. The volume of burnt gas in the cylinder has simply expanded into the exhaust pipe and has in no way emptied the cylinder. The piston, on passing from B to C, uncovers the inlet port and a quantity of explosive mixture enters, displacing an equal volume of burnt gas. From experiments the writer has made he places the quantity at less than one-half of the piston displacement, or, roughly, one-third of the space above piston when down. The piston, on rising from C to B, is free to suck back into the base a quantity equal to area of piston time distance C B. There will be no further inlet into base until the piston has advanced beyond this point sufficiently to produce a vacuum strong enough to lift the inlet valve. From B to A the piston actually forces out a small quantity of the new combination, and beyond that point it is a case of compression of old and new mixture in the ratio of about 2 to 1. It is not a difficult matter to arrange a governor to shut off the supply of gasoline so as to act on the hit and miss principle, and of course the motor would be pumping air through it when running and not exploding, but this would not give the smooth motion of a




four-cycle motor when throttled down. In our four-cycle motor the writer has adopted the following proportions for his exhaust valves: On cylinders 4 in., 4½ in., 5 in., 5½ in. and 6 in. diameter, 800 ft. per minute piston speed, the area of valve equals one-tenth area of piston. Thus, a 4½-in. cylinder of 15.9 in. area would have a valve of 1.59 in. area, which is practically 1 7-16 in. diameter. The valve, of special cast iron, with steel stem, has seat 45 deg. and a width of bearing equal to one-eighth of area [diameter?—Ed.], stem equal to one-fifth and lift equal to one-fourth of area.

By use of a properly shaped cam and opening the valve before the end of the working stroke, so as to free the cylinder of the terminal pressure, there should be very little back

pressure. With a piston speed of 800 ft. the velocity of gas through the valve opening is 8,000 ft. per minute, corresponding to less than 2 oz. pressure per square inch. The valve should open and close quickly, and owing to the accelerated motion of the piston the greatest opening should be about the middle of the stroke, while the angularity of the connecting rod causes the piston to pass the last half of the exhaust stroke in less time than the last half, which would tend to change velocity of gas through port.

W. S. HOWARD.

## Taste and Practice.

New York, May 21.

Editor Horseless Age:

Your editorial in the last issue is in line with a great deal that has been written in The Horseless Age about automobiles having a "horse wanted" appearance, and while I agree with the idea that they should not be built to look so intentionally, or attempting to hide their character, I fail to see any good reason why the lines of a well-designed horse-drawn carriage should not be adopted if same has merit and can be so used. I think it is altogether a matter of taste and dependent on the needs of each case.

As regards the dash, it is useful not only on account of protection from mud thrown by horses' feet, but also from the wind and weather, so why should it be discarded or made smaller if you have nothing to replace it, especially as there is generally more wind to be had in a motor vehicle? Designers of automobiles should be prepared to tear themselves away from former designs, if found necessary, but they should not shock our artistic feelings by clumsiness of design. Such a shock one gets when seeing, on a vehicle showing plainly enough what it is, a great big flat box made to look like a dashboard and concealing a tank. Would it not be better to use an ordinary dash and show the tank boldly, or else design a graceful form of box or dash that makes no attempt at deception?

It is hardly to be recommended to show more moving parts of the source of power than can be helped, as it is well to protect such from dust and weather; but otherwise it should be a matter of mechanical design whether to place same under the seat or body of the carriage, or over the front part under a hood. The former way should not be condemned because more like a horse carriage, and the latter can be made as graceful in appearance as any other style.

In view of the necessity for building automobiles with a low center of gravity, it is surprising that any should be built otherwise, yet one can see in daily use a number of electric vehicles with the body up so high in the air that they must be in constant danger of toppling over, and some day will do so. These have no horse wanted appearance.

H. W. S.

***The date of the Acetylene Motor Number, printed at the foot of Page 27 as JUNE 28th, should have been JUNE 20th.***

# OUR FOREIGN EXCHANGES.

## The Dawson Oil Motor.

Few oil motors, among the large numbers which have recently been introduced by various inventors and manufacturers, possess more interesting deviations from existing machines, or tend more convincingly to indicate the capabilities of the general system upon which they all work, than the Dawson motor. Among the well-known drawbacks attending the use of internal combustion engines are their inability either to start themselves or to reverse, their failure to exhaust completely, and their inflexibility of output. In the Dawson motor an attempt is made to overcome or reduce these difficulties by the provision of a compressed air system which is incorporated into the engine itself. By the means employed the motor can be started in either direction by utilizing air which has previously been compressed into and stored in a reservoir; it can be made to recharge the compressed air reservoir when desired; it can receive a scavenging charge of air into its working cylinder during a part of the exhaust period, and it can receive a greater and a variable volume of explosive charge during its intake stroke.

The construction of this motor differs from those hitherto known in the following respects: The cylinder, while still working on the usual four-stroke cycle, is nearly twice the ordinary length and contains a double piston; the back end of the cylinder is of one diameter, and the front portion is of a larger diameter. Each part of the double piston is provided with piston rings, and the two parts fit into and work in their respective portions of the cylinder; the smaller cylinder and piston constitute the oil engine proper, while the annular space which is formed between the piston and the larger cylinder enables that portion of the engine to be utilized either as an air pump or, alternately, as a pneumatic engine. A passage leading from the rear end of the larger cylinder is provided with a slide valve, and this valve is controlled, as in a steam engine, by means of an eccentric, which is driven by the engine; the eccentric is mounted upon its shaft in such a manner that it can be made to assume a concentric position about the shaft or to secure a reversing action upon the slide valve, by being returned to an eccentric position, but at an angle of 180 degs. from its original position. The slide valve controls communication between the air compressor or motor cylinder and a valve chest, and this valve chest is connected by means of a pipe to an air reservoir, and also, by means of a port, to a passage leading into the working cylinder. The valve chest contains two slide valves, which are connected together, and which are operated by hand; one of these slide valves controls the port leading from the air cylinder to the valve chest, and the other controls the passage from the valve chest to the oil engine cylinder; these slide valves alternately open or close one or other, or close both, of the passages which they control, but the former also acts as a non-return valve from the valve chest to the air cylinder when it is in its closed position. The air reservoir, which is the only portion of the mechanism otherwise than attached to and forming a part of the engine itself, is fitted with a non-return valve controlling the passage of air into the reservoir, a hand lever for opening this non-return valve when desired, and a safety valve.

The oil motor cylinder itself is fitted in very much the usual manner, with an atmospheric inlet valve, a cam-actuated exhaust valve, and a variably timed high-tension electric ignition device; but the petrol is measured and positively delivered to the mixing chamber by means of a variable stroke pump, the exhaust cam and the ignition device are arranged so as to allow the motor to work in either direction, and the governor, which is (like the oil pump mechanism) fitted to the main shaft of the motor, is arranged so as to cut off the oil supply at any desired speed.

The above general description of this motor will serve to explain its general principles. We will now proceed to a more detailed account of its construction, and for this purpose will refer to the drawings which are here reproduced.

In Fig. 1, A is a part of the oil engine cylinder, B is the air compressing and motor cylinder (of larger diameter than A), and C is the annular space which forms the working portion of the air cylinder. The piston, which is common to both cylinders, is provided with a connecting rod working direct upon a crank shaft in the usual manner.

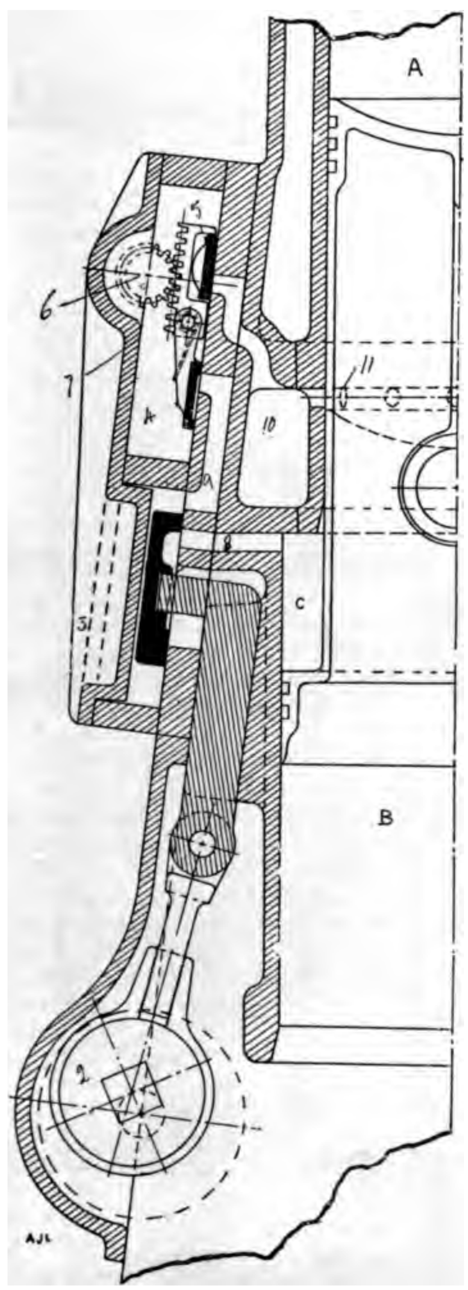



FIG. 1.—General Arrangement of Valves.

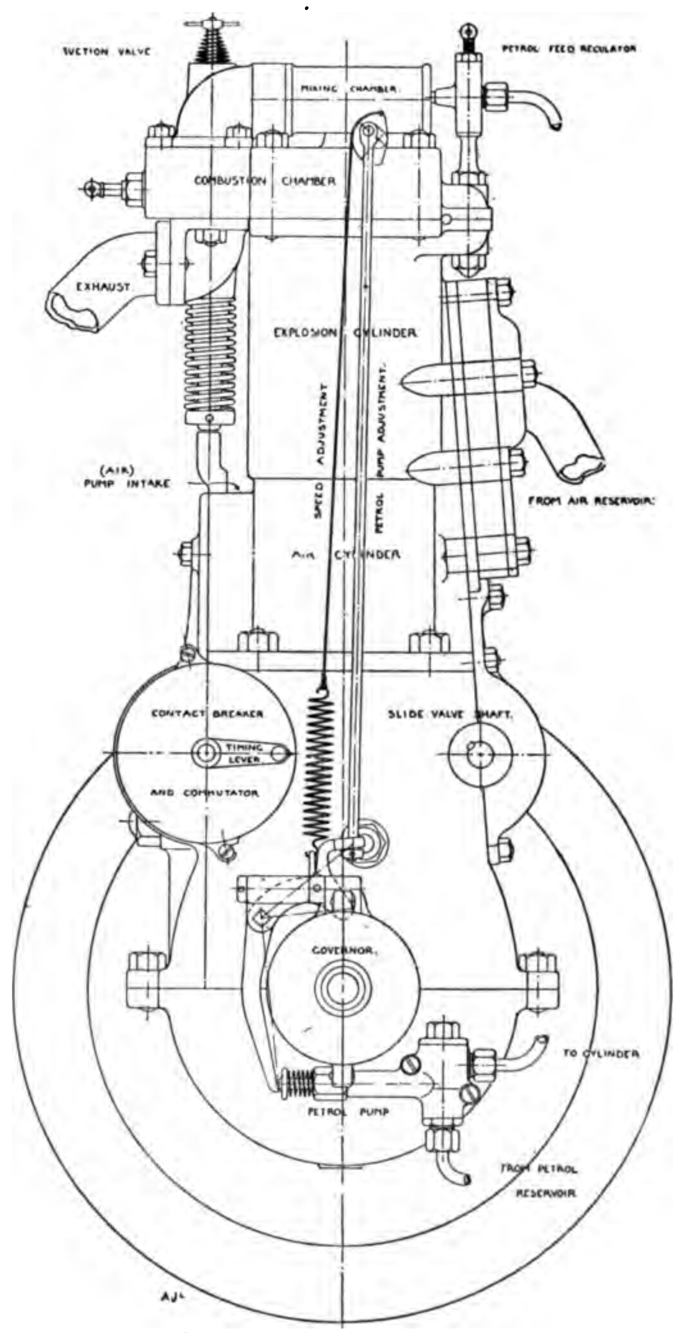



FIG. 2.—General Arrangement of the Engine

The eccentric 1 2, which is shown in Fig. 1, and more clearly in Figs. 3, 4 and 5, is mounted upon a shaft driven by and at the same speed as the crank shaft; the shaft D, carrying the eccentric block E and strap F, is shaped in the manner shown in the drawing (Figs. 3, 4 and 5) into a kind of oblique crank, having a square cross section, and as the shaft is free to move longitudinally in its bearings, the eccen-

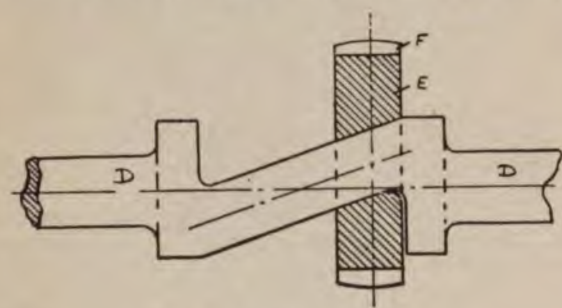



FIG. 3. FORWARD POSITION.

tric can be brought into a forward, a concentric or into a reversing position. The slide valve 3, which is operated by the eccentric, regulates the periodic communication from the annular space C through the passage 8 to the valve chest containing the valves 4 and 5, through the port 9, and alternatively to the atmosphere. The two valves 4 and 5 are connected together as shown in Fig. 1, and are so arranged that

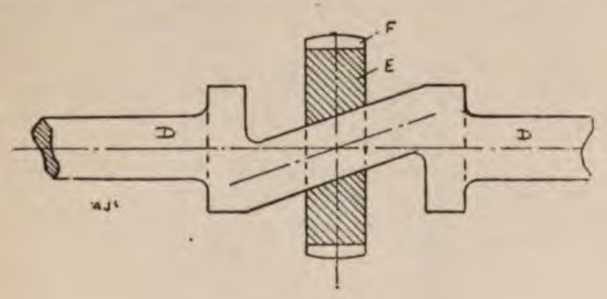



FIG. 4. MIDDLE POSITION.

they can be moved by hand, by means of the shaft and toothed wheel 6 and the rack 7; the valve 4, which constitutes a non-return valve, can be caused to cover the port 9, and the valve 5 to cover the port 10; the ports 9 and 10 can both be covered by their respective valves at the same time, but they cannot be both uncovered simultaneously.

In Figs. 6, 7 and 8 the three working positions of the valves 4 and 5 are clearly shown, and it will be seen: (a) That

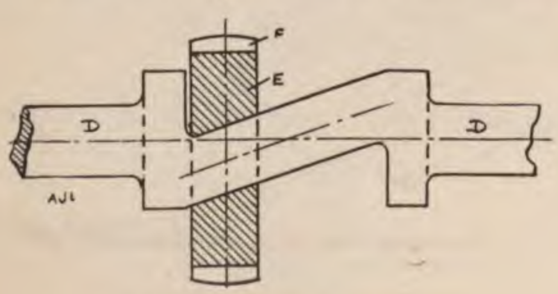



FIG. 5. BACKWARD POSITION.

in the starting position the compressed air, when allowed to enter the valve chest from the reservoir, has a free passage to the slide valve 3 and will start the engine running in one direction or the other, according to the position of the eccentric upon its shaft; (b) that in the charging position air will be drawn into the cylinder C from the atmosphere and will be forced past the valve 4 to the reservoir, provided that the

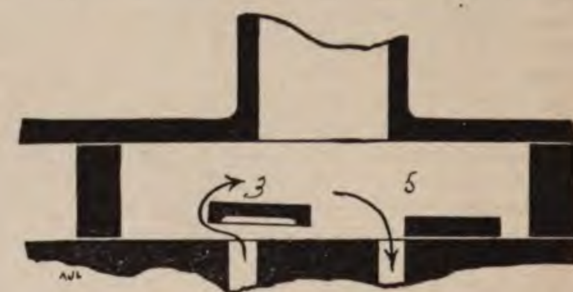



FIG. 8. "AUGMENTING."

eccentric is moved to the position at which it would tend, under starting conditions, to reverse the direction of rotation of the engine; (c) that in the augmenting position air will be forced from the cylinder C into the port 10, provided that the eccentric is in the "reverse" position. The port 10 leads, through the wall of the cylinder A, at a point where holes 11 in the piston arrive at the end of the forward stroke, and thus


FIG. 7. CHARGING AIR RESERVOIR.

the air drives out some of the burnt gases through the exhaust valve, when open, and also increases the volume of the charge during the suction stroke.

A general arrangement of the engine is shown in Fig. 2. As the various parts are named upon the drawing no further description is necessary.

Having now fully described the chief features of novelty, we need only add that the motor, as at present constructed,

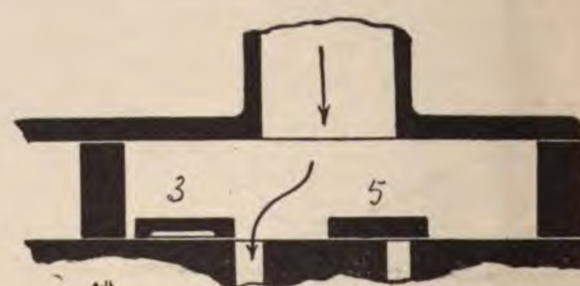



FIG. 6. STARTING AND NORMAL POSITION.

has three double cylinders working upon cranks set at an angle of 120 degs. from each other upon the main shaft, and thus there are no dead points which can prevent it from starting when in any position. It is, of course, necessary that the exhaust cams, as also the ignition device, should be mounted upon the half speed cam shaft in such a manner that they assume correct positions upon the shaft, relatively to the cycle of operations, for working in whichever direction the engine is started by the compressed air. This mechanical arrangement, although not shown in the drawings, is provided upon the motor and appears to work satisfactorily.

The value of the Dawson motor to automobilists depends upon the advantages gained, by the use of considerable additional mechanism, relatively to the disadvantages attending such an increase in the number of moving parts. Self-starting is undoubtedly an advantage, both from motor car constructional points of view and in order to avoid the present difficulties attending "no load" running, when the car is standing; the further convenience of being able to start the engine from the driver's seat is considerable, although this is daily becoming less essential, but more simple to arrange, in consequence largely of the comparative ease and certainty with which the motors now get under way. Reversing, as such, saves the provision of a separate reversing gear upon the car, but, on the other hand, not only (in the Dawson motor)

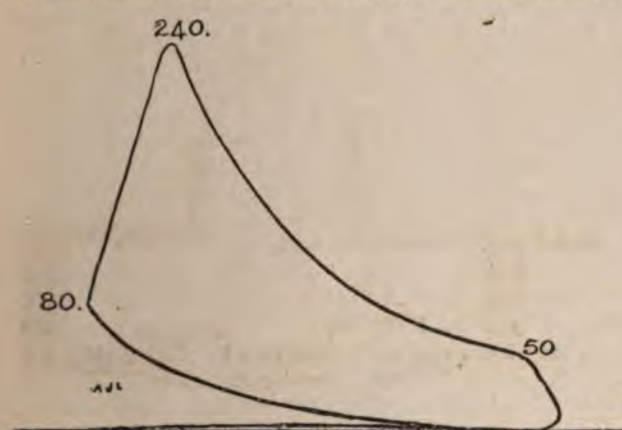



FIG. 9.
Normal Charge. M.E.P.: 84 lbs. per sq. inch. B.H.P.: 8·88.

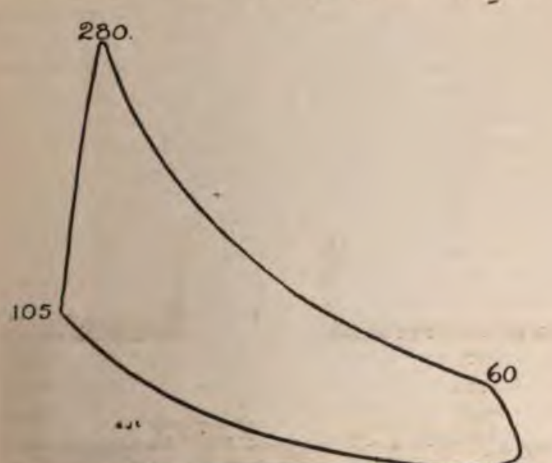



FIG. 10.
Half Augmented, same Petrol Supply. M.E.P.: 116 lbs. per sq. inch.

involves the use of the same apparatus as is employed for self-starting but it necessitates the provision of additional mechanism upon the cam shaft, as has been above mentioned.

By far the most important object which the inventors have had in view is that which they call "power augmenting"—i. e., increasing the quantity of the combustible charge, and consequently increasing the density and the compression over a large and variable range. The indicator diagrams, seen in Figs. 9, 10 and 11, clearly show the extent to which this principle is applied. Although in these diagrams the initial pressures are very low and the range of compression is between 80 lbs. and 140 lbs. per square inch, yet the range of horsepower (at constant speed and with regular working) is considerable. This flexibility in the energy of each explosion, coupled with the attendant increase of output, relatively to the weight and sizes of the engine, render the Dawson motor particularly interesting and instructive to automobilists generally. From this point of view, and from this point of view only, the additional mechanisms employed upon the motor seem to be justified, particularly if the range of output can be further increased, without further complication and with equal success. That the other conveniences, which are more or less essentially provided by the same arrangement of parts, are also secured is perhaps a matter rather for congratulation than of equal moment at the present time, and we should have awaited the results of further practical experience with them before expressing any definite opinion regarding either their utility or their practical importance, if they alone were the advantages secured by the arrangement.

Among the possible advantages secured by the Dawson motor, of a similar "by-product" nature to those of self-starting and reversing, is the brake action, which can be brought to bear upon the engine by manipulating the compressed-air controlling valves in such a manner that the piston in the air cylinder is retarded in consequence. The general system of applying a flexible cushion for this purpose of braking has many obvious advantages in its favor.

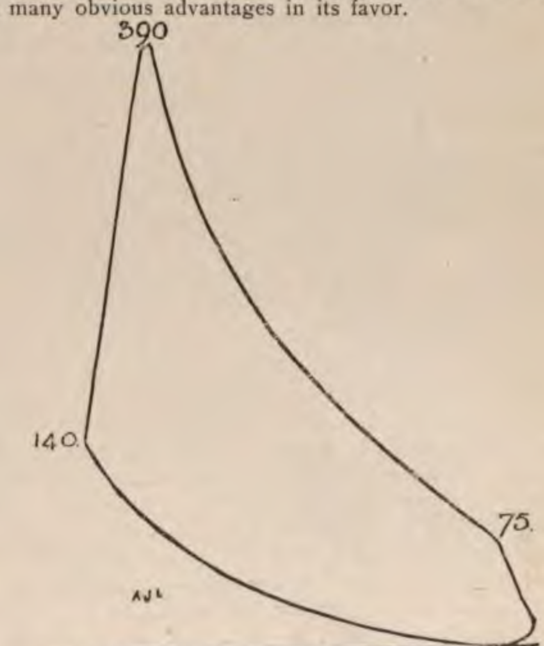



FIG. 11.
Fully Augmented, increased Petrol Supply. M.E.P.: 147 l per sq. inch. B.H.P.: 12·51.

Much as we should have liked, considering the novel features of the motor, to have furnished particulars as to the practical results obtained, together with actual figures as to the oil consumption under the various working conditions, we are unable to do so in the present issue; we hope, however, in a future number, to deal more fully with this subject, and to enter also into the minor details of the cam shaft arrangement and of the oil feeding and governing devices. Messrs. Dawson's patent specification is No. 26,505 of 1898.

We are informed by the manufacturers and inventors that the estimated additional cost of construction is not more than 33 1-3 per cent. above that of an ordinary motor of the same size; that the cylinder (oil and air) dimensions (of the three-cylinder motor) are 3½-in. and 4½-in. bore respectively by 5-in. stroke; that the motor speed is from 400 to 800 revolutions per minute, and that the air reservoir works normally at 60 lbs. per square inch pressure, and has a cubic capacity of about 7 cu. ft. (20 in. diameter by 40 in. long). We are also assured that the air apparatus is capable of use as a brake, absorbing 6 h.p. continuously in a 6-h.p. engine when descending steep hills.—The Automotor Journal.

## Necessary Gas Engine Conditions.

By Ernest S. Cooper.

Underlying the successful operation of all gas or gasoline engines are three conditions which must be fulfilled and be performed in proper sequence before an impulse can take place within the cylinder, viz., mixture, compression and ignition. While these terms have not the phonetic alliteration of the three R's, the recognized essentials of our education, yet they are as absolutely necessary to gas engine practice, and the absence of any of them will surely make the others of no effect, and no one, no matter how expert in gas engine practice, has ever been able to start an engine running without the three conditions being fulfilled. I have seen "shopmen" fairly stuck up over the starting of an engine, get rattled and "say things" that were neither orthodox nor refined, but which were, nevertheless, easily understood, and, from an outside point of view, quite excusable.

Manufacturers do not take means enough to hammer into the minds of gas engine operators and their own shop "experts" the importance of always seeing that these three conditions are fulfilled if the engine does not seem to run right or start handily. It would very often save the sending of a man 100 miles from the shop to do five minutes' work, and also the consequent dispute as to whether the shop or the engine owner should stand the expense. It must be remembered that these three conditions are absolutely necessary to the operation of any design of gas engine of either the two-stroke or four-stroke cycle, and whether used for stationary, marine or motor vehicle purposes; and by the term gas engine I mean all internal combustion engines, whether using gas of any description, gasoline, kerosene or crude oil for fuel.

During the boating season of 1899 I was the recipient of large, healthy tales of woe from two parties using different makes of "two-stroke cycle" marine engines, which had given good satisfaction for two seasons, but last season had bucked most shamefully—so badly, in fact, that being carried a round trip by power was the exception, and frequent use had to be made of the pair of oars carried for cases of emergency only.

Now, the first thing to do in a case of this kind is to put the gas engine catechism, viz., Do you get compression? Do you get a good ignition spark? In case of using a hot tube igniter is your tube hot enough to cause ignition? Do you get the proper mixture in the cylinder?

Turning the fly wheel over will show in ten seconds if the compression is right or not, so when they stated they had good compression, that could be depended on. Now, if you use a tube igniter, it is only a matter of looking down the chimney at the tube, and, unless your judgment is greatly at fault, you will know at once if it is hot enough to ignite. With electric ignition the fact as to whether a spark is actually passing at the electrodes or not is not always so readily determined, for the reason that probably no means of seeing the spark pass has been provided by the builder, the only means available being by removing the cylinder head or breaking some packed joint, and moving the igniter by hand, which does not always make it operate under the same conditions as when the engine is running. Right here I would like to remark that I would not, under any consideration, have a gas engine using electric ignition that was not provided with convenient means of enabling one to actually see the spark pass at the electrode. It is by no means difficult to provide for it in the original design and it is of too much practical importance to the actual operator of the engine to be neglected as much as it is by gas engine builders.

To return to our friends in trouble, they had compression and thought they had ignition and mixture also. This, however, could not possibly be the case or the engines would have run. On talking the matter over I found they had kept turning the wheel over and giving the mixture every possible variation, had tested the gasoline with a hydrometer and found it correct, but all they could get was an occasional impulse, and sometimes the engine would run for a few minutes in a half-hearted way. It seemed reasonable to suppose that the mixture reached the cylinder all right, so with compression and mixture right it was evident that the ignition was at fault. Neither party could bring himself to think such was the case, as they could feel the current pass by placing their fingers on the insulated electrodes and cylinder head. They no doubt felt a slight shock from the current, but it was no proof that a good spark was passing at the electrodes. Their only means of seeing the spark was by taking off the head, when by moving the igniter by hand they would secure a small spark. I still contended the trouble lay in the spark, and, after losing a large part of the season's pleasure, it was found that when the igniter was worked fast by the engine running, one electrode had become slightly worn and was thrown out of place, causing failure of the spark. When this was remedied everything moved off correctly and no more serious trouble was run across.

When you find compression gone, it is escaping through leaky valves, a defective joint, or possibly past the piston, and the respective remedy must be applied. The causes of imperfect mixture are sometimes hard to locate, and this depends on the design of the engine. Dirt or scale in the gasoline passages, which are generally small, will cause a weak charge. Foreign matter preventing the gasoline valve from closing tight will cause too rich a charge, but the effect is almost the same as a weak one, for you can just as surely shut down your engine by feeding too much fuel as by closing it off altogether.

Cases almost similar to the ones mentioned are continually occurring, but by simply remembering the fact that if you

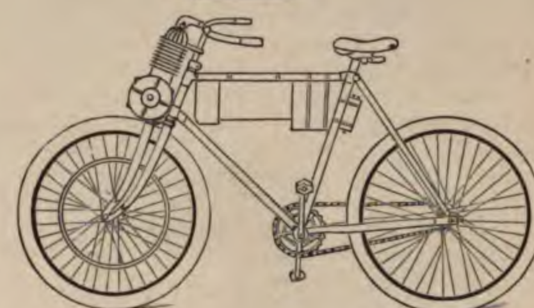
get the proper mixture in the cylinder, compress it and ignite it, there is no reason on earth why that engine won't run, and when having trouble with an internal combustion engine that there are only three essential conditions to be fulfilled before an engine will run, viz., mixture, compression and ignition.—The Canadian Engineer.

## The Werner Motor-Bicycle.

La France Automobile thus describes the Werner motor bicycle, made by Werner, Frères & Cie., 40 Avenue de la Grande Armée, Paris:

The motor of the 1900 model runs normally at 1,500 revolutions per minute; it weighs 9 kilos (19.8 lbs.), and is taken to pieces very readily, the cylinder and head being held by bolts hinged to crank case. It is mounted on the front fork with three bolts, whose unscrewing leaves it entirely free. The sparking cam and trembler are inclosed in a small aluminum case below the exhaust valve. The crank case is water tight, and oil is supplied from a closed cup on its upper part. All the controlling members are on the handle bar within easy reach. The right hand controls the electricity, the left hand adjusts the carbureter, and steering is as easy as with an ordinary bicycle.

The maximum speed of the bicycle is from 40 to 50 kilometers (24 to 30 miles) per hour, according to the ratio of gearing. The power is transmitted by a belt, tightened by hooks, from a pulley on the motor shaft to a grooved rim or pulley on the front wheel. The diameter of the pulley may be chosen according to the travel for which the machine is intended, whether on level or hilly roads, and the speed may be regulated from 15 kilometers (9 miles) up by varying the ignition lead. Pedaling with the feet is not required except on steep hills.



The weight of the machine is from 30 to 32 kilos (66 to 70 lbs.), complete. The pedals are connected with the rear wheel on the "free wheel" principle. They are used to start the machine, and thereafter serve as foot rests. A brake controlled by a hand lever acts on a drum on the rear wheel, and will stop the machine in the space of a few yards.

The carbureter is suspended from the horizontal tube of the frame. It holds gasoline enough for a journey of 75 kilometers (45 miles). It gives a constant mixture, and when once filled needs no further attention. A dry storage cell is used.

## Le Critérium de l'Electricité.

One frequently hears the complaint from supporters of electric traction that their system is grievously slighted in the matter of competitions and races, and that practically all the encouragement and attention is besowed upon the petrol cars. Well, there is a good deal of truth in the remark; but, on the other hand, constructors of electromobiles have partly to thank themselves for this condition of affairs, for when an event is organized for them they support it but very poorly. The "Critérium de l'Electricité" is a case in point. Promoted by "Le Vélo," this event had for object the demonstration of the staying powers of electrically propelled vehicles, and its regulations were framed on the easiest of lines. What happens? Only three constructors respond to the invitation! Out of the many makers of electromobiles only three are courageous enough to put their productions to a public test! Make all the excuses possible, the exhibition, the orders on hand, etc., etc., and one cannot explain away the apathy displayed by the electric people toward this competition, specially organized in their interests. But to deal with the contest itself. As the test was one of endurance only, with the sole proviso that the average speed maintained should be at

least 16 kilometers (10 miles) per hour, a course of impossible length for electric cars was selected. This was Paris-Dijon, a distance of some 350 kilometers, which is at present just a shade beyond the scope of an electromobile on one charge. Two optional times of departure were given to the three competitors, one at 8 a. m. and the other at 10 p.m., and it was at the former of these that M. Cuvelier, mounted on his little car, which only carries 480 kilos of accumulators, made a start on his voyage of discovery. The early portion of this car's career was conducted against a strong head wind, but nevertheless a creditable performance was achieved, the total distance eventually covered being 140 kilometers (87½ miles), over a fairly trying route. M. Kriéger's car not putting in an appearance at the appointed time on the evening of the 26th. inst., the B. G. S. vehicle started alone, having on board MM. Garcin, Bouquet and Prade. Unfortunately, at Villeneuve-la-Guyard a short circuit was produced in the controller, and after a couple of hours' work the idea of proceeding further was abandoned and the occupants of the car had to rest content with the 92 kilometers already covered. As for M. Kriéger, who, as above stated, was behind time at the contrôle de départ—well, once started, he made excellent progress and eventually completely outdistanced his rivals. The car which he drove was of the well-known "Duc" type, carrying the accumulators in front. These accumulators weighed 1,032 kilos, and the total weight of the vehicle was 1,980 kilos, while the passenger accounted for an additional 160 kilos. The record of the run made by this car was 152 kilometers, the point of stoppage being some 8 kilometers beyond Joigny; this distance was covered at an average speed of 16 kilometers 84 meters per hour. No accident whatever occurred to mar the perfect harmony of the run, and, as well may be imagined, M. Kriéger was delighted with his victory. He hopes that next year he will be able to place on the market a vehicle with a range of 250 kilometers; at any rate, it will be a car possessing infinitely greater staying powers than those of this year's competitor, and if this anticipation is realized we shall see within a few years the Paris-Dijon journey made on a single charge.—Motor Car Journal.

## Kerosene in an Emergency.

In the current number of Chambers' Journal Dr. Dawson Turner, of Edinburgh, gives some of his experiences with motor cars. His first car was a De Dion-Bouton quadricycle, and he tells how on one occasion when his stock of petrol was exhausted he filled the reservoir with ordinary lamp oil. He then made a bonfire with some newspapers under the reservoir, continuing the heating until the vapor of the lamp oil could be seen escaping up the float chimney. The result was magnificent, and the following 6 miles were covered at a great speed. On the motor slackening the experiment was repeated with success. Dr. Turner did all these things in his innocence, and, needless to say, does not recommend others to do likewise.—Motor Car Journal.

## CAN YOU GET US NEW SUBSCRIBERS?

**Any of our subscribers who are willing to solicit subscriptions for THE HORSELESS AGE from their fellow townsmen, are requested to communicate with the Editor.**

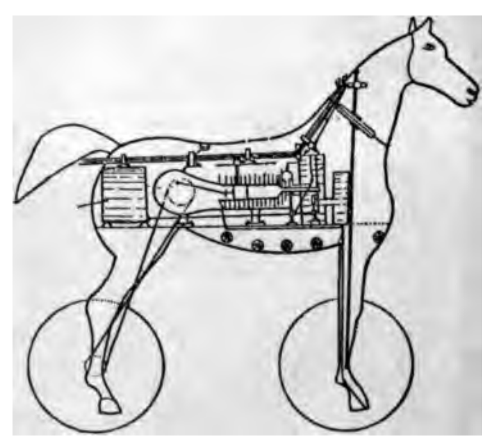
## British Motor Shares "Dirt Cheap."

As the motors are prominently before the public this week, coughing their way across the country, there is something sadly inauspicious in the fact that business in British Motor preference took place in the Industrial Market yesterday on the basis of 3d. a share. The heavy fall may, perhaps, have some connection with certain pending legal proceedings which are believed to have had their real origin in an attempted deal in the shares; but that is a matter upon which we can only speculate.

The British Motor Co. was registered in 1895, and the authorized capital is now £1,000,000 in £1 shares, and £250,000 has been issued and paid up. The best known of the directors of the company are Prince Ranjitsinhji and Mr. H. J. Lawson. The attempted deal in the shares of the company at the end of last year will be still fresh in the public mind.—Financial News.

## An Auto-Motor Horse.

We thought it a somewhat curious objection to the motor car that its one fault was that, unlike the ordinary horse carriage, it had nothing in front to steady it. Upon the first glance at our illustration it might be thought that the inventor of the auto-motor horse had had this very thought in mind; but the auto-motor horse is not intended to steady the motor car; it is to take the place of the horse, containing within itself the motive power, by which it is to draw the carriage or conveyance behind it. The motor mechanism, which is contained within the body of the horse, consists of one or two motors supported upon cross bars and driving through chains or belts the shafts of the driving wheels mounted on the hind legs of the horse, as shown in our illustration.



The steering is effected by means of reins or rods held by the rider or driver, the neck of the horse being for this purpose intersected and mounted upon ball bearings, the reins being attached to a cross head mounted on a vertical spindle, to the lower end of which are attached arms contained within the forelegs and connected to the axle of the front wheels. We have no doubt that the appearance of Mr. Emille Langrenne's auto-motor horse in our streets will cause something of a sensation.—British Invention.

## MINOR MENTION.

An automobile club has been organized at Rochester, N. Y.

A motor stage line is projected to run between Elizabeth and Morristown, N. J.

The Co-operative Wheel Co. has been organized at Toledo, O., with $5,000 capital.

The Bethlehem Steel Co. has opened an office in Denver, Col., at No. 4 Bank Block.

The City Council of Newport is considering an ordinance regulating the use of motor vehicles.

A motor vehicle exposition will be held in Nuremburg, Germany, from June 1 to July 1 of this year.

The National Automobile & Electric Co., of Indianapolis, Ind., expect to have their new factory ready by June 1.

Seven users of motor carriages at Harvard University have joined forces to maintain a club stable for their machines.

Louie J. Harris, the Boston excursion manager, has taken out patents on motor vehicles and is at work on their construction.

About two hundred automobile licenses have been granted in Chicago, and the ordinance requiring them is being enforced strictly.

A public motor vehicle is soon to be in operation between Mansfield and Shelby, O. It will make four trips a day and the fare will be 60 cents the round trip.

Frank Lambkin, of Cleveland, has recently arrived in that city after a trip from New York in a "Mobile" steam carriage, purchased just before the trip was begun.

The Lozier Motor Co., of Toledo, O., who are well known as the makers of the Lozier two-cycle launch engine, are reported to be meditating the establishment of a motor vehicle plant near New York City.

Wallace Brothers, Wallaceton, Va., agents for the Duryea Power Co., Waltham Mfg. Co. and Columbia Motor & Mfg. Co., and dealers in gasoline yachts, will have a space at the Maryland Sportsmen's Exhibition this week.

The Philadelphia Park Board has adopted the following resolution: "Resolved, That the rules permitting automobiles to use certain drives in the Park be further amended by adding Ford Road from Chamounix Drive to Woodside Park, and Belmont Drive to Chamounix Drive, and to the concourse of Belmont Mansion."

The Philadelphia Automobile Club has been fully organized, and its officers are as follows: President, Henry G. Morris; vice-presidents, Herbert Lloyd, Pedro S. Salom and J. H. Harding; secretary and treasurer, Frank C. Lewin. For the present the club will meet at the Hotel Flanders. The present membership is 42.

James Ward Thorne, a student of Princeton University of the class of 1900, has started on a tour across the country in a specially constructed motor wagon. The latter is a long, closed affair, with several compartments, provided with cooking utensils, beds for three persons and a storage room for guns, fishing tackle and cameras. No attempt at a time record for the trip will be made.

George Percival Stewart, late of the bogus "Franco-American Automobile Co.," the "Granite State Provident Association," the "American Investors' Trust" and the "American Investors' Co.," is again in the toils of the law, this time on testimony given by deluded stockholders of the Hornellsville Rent Purchase Society. Stewart is said to be under indictment on half a dozen different charges, all relating to schemes for defrauding investors.

About fifty vehicles out of the eighty or so starters completed the 1,000-mile trial in England. All the finishing vehicles had traveled a minimum of 1,060 miles, while the total of those that took part in the optional hill-climbing contests reached a little over 1,100 miles. There were 11 actual running days, the balance of the time being made up of Sundays and one-day exhibitions. The longest journey was on the last day, 123½ miles, and the shortest was the 61½-mile run from Kendal to Carlisle, which included the hill-climbing competition up Birkhill. One of the surprises of the trial was the endurance showed by the voiturettes.

A line of electric stages will be run between Lyons and Sodus Point, N. Y., a distance of 14 miles. A project for a trolley line connecting the towns was blocked by the high price demanded by farmers for the right of way. President O. F. Thomas, of the Bank of Wayne, who is a director of the General Carriage Co., of New York, has placed an order with that company for three coaches of a seating capacity of 20 passengers each, and these are expected to make regular trips this summer over the above route. Mr. Thomas is interested also in the new Empire State Sugar Co., of Rome, N. Y., and has ordered 10 electric trucks, each of 5 tons capacity, to be used to cart sugar beets from farms to the refinery.

## METROPOLITAN NOTES.

The Hasbrouck Motor Co. has decided to locate its New York office at 20 Nassau St. instead of at 68 Broad St., where it is at present.

The A. L. Bogart Co. has just issued a circular describing their Automatic Electric Igniter for steam vehicle burners, which will be sent free on request.

G. E. Hall, of 211 Centre St., New York, is offering the owners of steam and gasoline carriages free samples of the "Locobile," a special lubricant for cylinders.

E. D. Williams & Son, Jersey City, have recently received an order from the Maltby Automobile Co., of Brooklyn, for 50 sets of their aluminum motor castings.

The new Excelsior Dry Battery Co., New York City, have moved into larger quarters at 108 Greenwich St. and have thereby increased their facilities for turning out orders promptly.

The Federal Motor Vehicle Co., incorporated under the laws of New Jersey, is intended to handle the Pennsylvania Railroad's cab transportation from the projected Long Island terminals of that road to New York City.

Flandrau & Co., 372-376 Broome St., New York, intend building bodies and running gears complete for automobiles. leaving the motive power to be supplied at the option of the purchaser. They will carry these in stock, and the first one, built for Mark Hopkins, of Philadelphia, is at present on exhibition in Wanamaker's Annex, New York. It is fitted with a motor from the General Electric Carriage Co., of Philadelphia, and is constructed in the highest style of workmanship and finish.

# MOTOR VEHICLE PATENTS of the world

## UNITED STATES PATENTS.

No. 648,059—Motor Vehicle.—Edwin S. Sutch, Philadelphia, Pa., assignor of one-half to D. T. Keenan, same place. April 24, 1900. Application filed July 8, 1899.

A friction cone transmission.

Six claims.

No. 648,328—Motor Car.—James C. Anderson, Highland Park, Ill. April 24, 1900. Application filed Sept. 5, 1899.

No. 648,329—Engine.—James C. Anderson, Highland Park, Ill. April 24, 1900. Application filed Oct. 10, 1899.

No. 649,330—Motor Car.—James C. Anderson, Highland Park, Ill. April 24, 1900. Application filed Oct. 28, 1899.

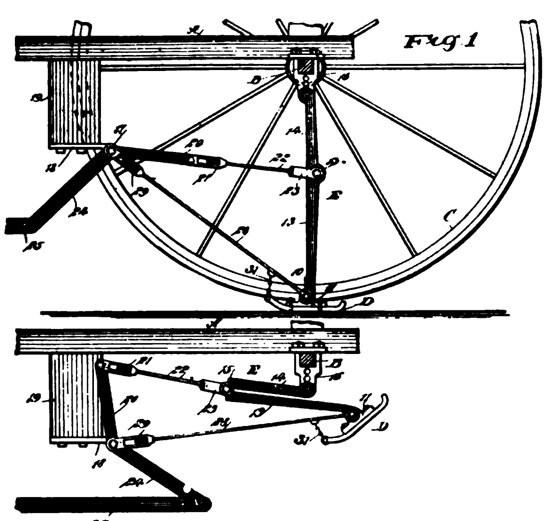
No. 648,408—Self Pumping Pneumatic Vehicle Wheel.—William Hayes, Boston, Mass. May 1, 1900. Application filed March 14, 1900.

A combination, with a wheel and pneumatic tire, of a pump operated by an eccentric on the axle, and a safety valve to prevent the air pressure produced by the pump from exceeding the safe limit for the tire.

Four claims.

No. 648,736—Automobile Truck.—Warren P. Freeman, New York, N. Y., assignor to the Empire Electrical Machinery Co., same place. May 1, 1900. Application filed May 6, 1899.

No. 648,778—Vehicle Brake.—R. C. G. Neumann and George L. Hartmann, Seattle, Wash. May 1, 1900. Application filed Aug. 9, 1899.

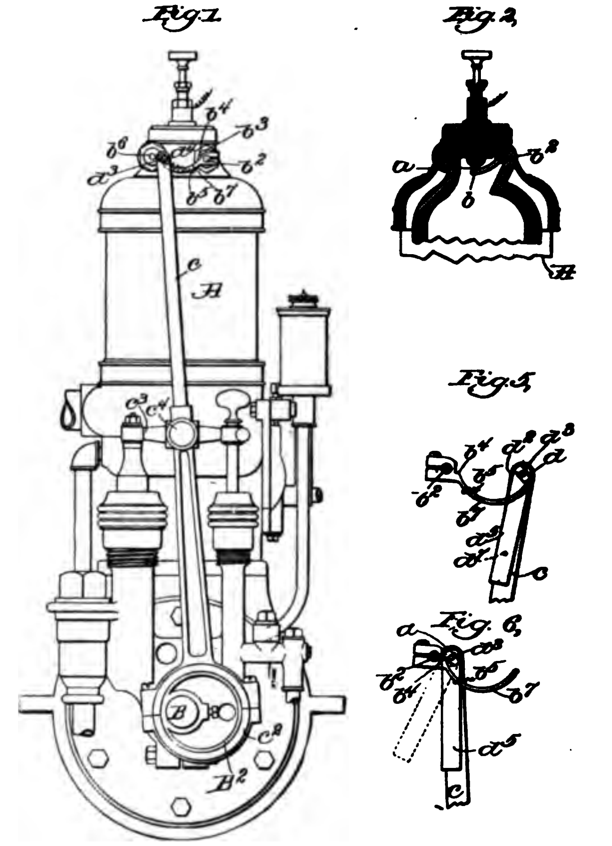


This brake is designed to lift the rear wheel from the ground and relieve the tires of the wear due to braking. The principle of its operation is clearly shown by the drawings.

Four claims.

No. 648,520—Circuit Breaker for Gas Engines.—J. A. Ostenberg, Westminster, Vt., assignor to F. M. Gilbert, Walpole, N. H. May 1, 1900. Application filed Nov. 6, 1897.

This igniter is not of the snap or hammer blow variety, but it is designed to produce a relatively quick break and a slow closing is produced by a mechanical movement from an eccentric. Fig. 1 is a general view of the engine, showing the eccentric at $B^2$. The eccentric rod is pivoted at $c^4$ on the cross arm connecting the two pump plungers, the same eccentric being thereby made to operate both pumps and the igniter. The claims, however, are limited to the igniter. Fig. 2 is a vertical section showing the contact finger b pivoted on the stem $b^2$, and Figs. 5 and 6 are details of the actuating mechanism outside, as they would appear if looked at from the back of Fig. 1 with the cylinder head removed.



The upper end of the rod c moves in an approximately elliptical path whose major axis is horizontal, and the motion, referring to Figs. 5 and 6, is from right to left or in the opposite direction from that of the hands of a clock. Consequently the block or wiper d strikes the shoulder $b^4$ of the arm $b^7$, which is fast on the stem $b^2$; and as this shoulder is close to the stem the contact point b (Fig. 2) is separated from the fixed electrode with a movement whose rapidity is considerably greater than that of the eccentric. The spark produced, the block d moves to the right along its path, and the curved portion of the arm $b^7$, which is held against the block d by a spring, $b^5$, is made of such a shape that electrical contact is re-established by b just before d slips off the end of the arm $b^7$, and also so that $b^7$ is moving its slowest at that moment.

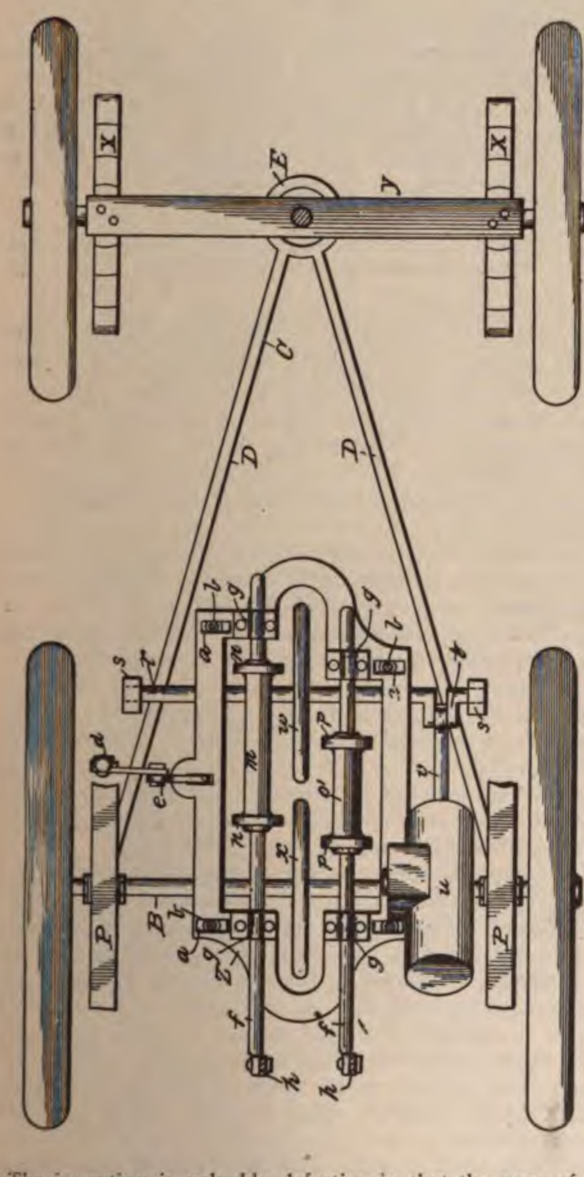
To regulate the lead of the ignition, the block d is not made solid with c, but is mounted on an arm, $d^8$, pivoted at

$d^3$ to c; and by setting $d^3$ at different angles the wiper d will strike the shoulder $b^4$ sooner or later, as desired.

Eight claims.

No. 648,654—Automobile Carriage.—Howard Cramer, Newberry, Pa., assignor of one-half to T. M. Robbins, Williamsport, Pa. May 1, 1900. Application filed Jan. 2, 1900.

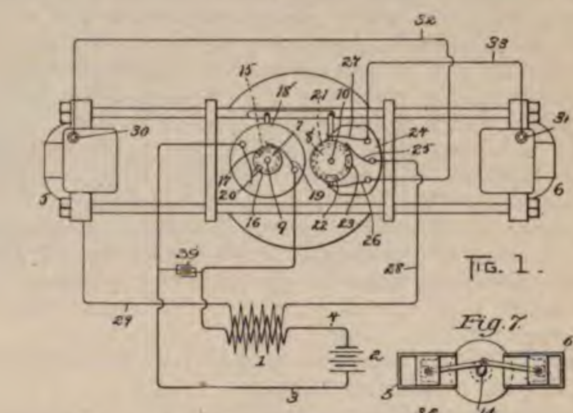
Two friction disks, w and x, are keyed respectively on the motor shaft and the axle. A laterally movable frame, z, controlled by a hand lever, d, carries in bearings two friction spools, either of which may be made to bear with its flanges on the sides of the friction disks w x, and both of which may be shifted axially by suitable levers. As will be seen from the drawing, these spools are of different lengths, so that the shorter one will drive the wheel axle in a direction opposite to that of the motor shaft's rotation, while the longer one drives it in the same direction, and the latter is used for the reverse motion of the vehicle.

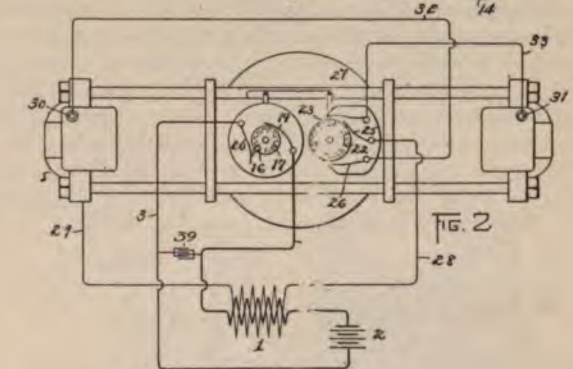


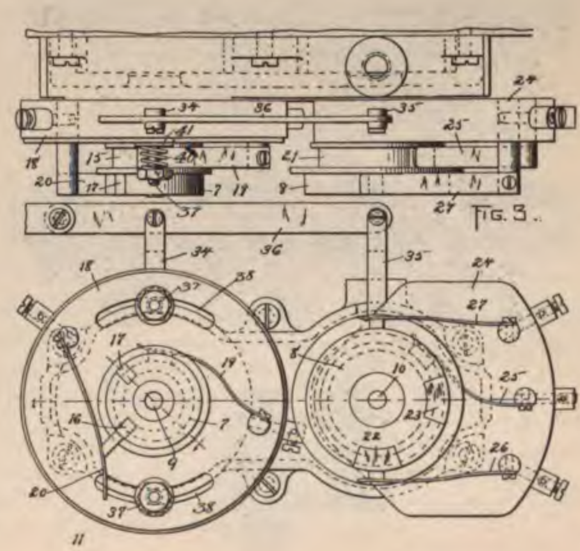
The invention is palpably defective in that the axes of the spools are necessarily above (or below) the axes of the disks, and hence the disks will exert a constant endwise dragging force on the spools, which may be expected to wear out the latter in short order, besides making the shifting of them by levers in the driver's hands an awkward matter. There is not a detail of the mechanical arrangement, shown or claimed, that would recommend itself to the intelligent designer.

No. 648,689—Igniting Device for Gas Engines.—Llewellyn Hutchinson, Cambridge, Mass., assignor to E. D. Mellen, same place, and Isaac H. Davis, Boston, Mass. May 1, 1900. Application filed Nov. 11, 1899.

This is a particular arrangement of circuits and commutators for jump spark igniters, and is shown as applied to a two-cylinder of the opposed type, with both pistons working on one crank pin. In Figs. 1 and 2, 2 is the battery, 1 the



coil, 30 and 31 the sparker plugs, 7 the primary circuit commutator, and 8 the secondary circuit commutator. Both commutators are driven in the same direction by a pinion on the crank shaft, and at half the speed of the latter. Figs. 1 and 2 are identical except that in the latter the commutators have rotated each 90 degs. from their position in the former. The brush 19, mounted on an insulating disk, 18, bears against a continuous ring, 15 (Fig. 3) in electrical connection with the metallic segments 16 17 in the insulating disk 7. The primary circuit is therefore closed twice in each revolution of the commutator, corresponding to the moments of ignition in the two cylinders. The brush 25 bears against another continuous ring, 21 (Fig. 3), and the two brushes 26 27, bearing at opposite points on the disk 8, are connected one with the igniter of one cylinder and one with that of the other; and the metallic segments 22 23, in electrical connection with the ring 21, pass successively under both brushes. As will be seen by comparing Figs. 1 and 2, the secondary current is led first to one cylinder, then to the other, alternately, at the moments when the primary circuit is closed at the brush 20. The two sets of brushes are mounted on independent insulating disks 18 and 24, which are pivoted concentrically with their commutators, and the ignition lead can be varied by shifting the disks angularly around their centers, for which purpose they are connected by arms 34 35 and link 36.

Two claims.

649,020—Variable Gearing.—Colcord Upton, Beverly, Mass. May 8, 1900. Application filed June 7, 1899.

This gearing provides two forward speeds and one reverse, all thrown into and out of action by friction clutches.

In Fig. 1, 1 is the driving and 17 the driven shaft, on which run loose the slow-speed pinion 4, the high-speed pinion 5 and the reverse pinion 6, each keyed to one member of the friction clutches shown. The gear 22, meshing with pinion 5, carries the differential pinions 26 and drives the shaft direct, and in its own direction of rotation, when the clutch 8 is put in action. The gear 22 carries the three studs 24 (two being visible), on which turn freely the pinions 21, which mesh with an internal gear, 23, secured to the outer shell, and with the pinion 20 on the hub of the gear 16. When the slow forward speed is desired, the clutch 7 is made fast and gear 16, revolving loosely on the sleeve 18a and driven by the pinion 4, rotates the pinion 20. The pinions 21 will therefore be driven in the same direction as the gear 16, and the velocity of translation of their centers will be half the pitch line velocity of the pinion 20.

To reverse the driven shaft 17 two pinions are provided on a short shaft, 33 (Fig. 3), meshing, one with the pinion 6 and the other with the gear 16, and thereby pinion 6 is made to drive gear 16 in the opposite sense from what it is by pinion 4.

A hand brake, 29, is provided on the differential, and suitable forks are provided to shift the thimbles 13, which tighten the clutches.

Ten claims.

Fig. 1.

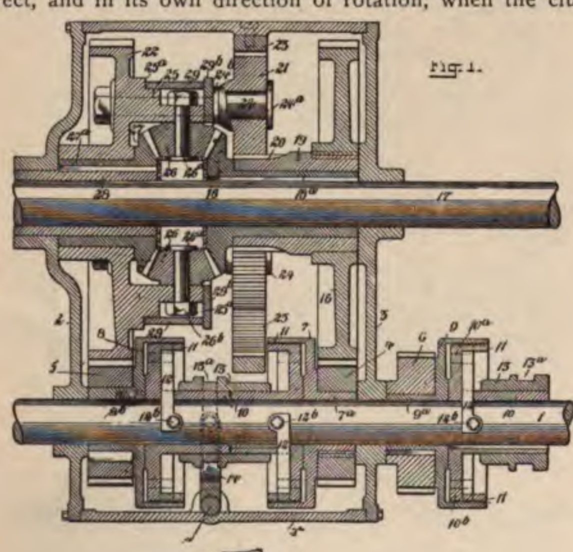


Fig. 3

649,003—Envelope for Storage Batteries.—Elmer A. Sperry, Cleveland, O. May 8, 1900. Application filed Oct. 7, 1899.

This is a special preparation of cellulose, inert to the acid and gases of the battery, which may be used to hold the active material of pasted plates from becoming detached and falling to the bottom of the cell.

Eight claims.

No. 649,098—Means for Securing Tires to Wheels.—Richard A. Brine, Revere, Mass. May 8, 1900. Application filed March 28, 1900.

No. 649,117—Vehicle Wheel.—Wm. H. Strutt, New York, N. Y., assignor of one-half to Alfred Reeves, same place. May 8, 1900. Application filed April 7, 1900.

No. 649,324.—Carbureter for Explosive Engines.—Veuve L. Longuemare, Paris, France. May 8, 1900. Application filed Nov. 7, 1899.

This was described in The Horseless Age of April 4.

Three claims.

No. 649,291—Body Hanger for Vehicles.—J. J. Fetzger, Columbiana, O., assignor to the Herbrand Co., Fremont, O. May 8, 1900. Application filed July 20, 1899.

An attachment connecting the vehicle body to the top half of a double elliptic spring.

Six claims.

No. 649,360—Universal Joint for Horse-Power Mechanism.—J. H. Ruch, Elgin, Ill. May 8, 1900. Application filed Feb. 16, 1900.

A combination with a universal joint of a clutch of the roller grip type, transmitting power in one direction only.

Two claims.

No. 649,491—Electric Storage Battery.—Elmer A. Sperry, Cleveland, O. May 15, 1900. Application filed Sept. 30, 1899.

No. 649,566—Body Hanger for Vehicles.—Lewis Burg, Dallas City, Ill. May 15, 1900. Application filed March 8, 1900.

An attachment connecting the vehicle body to the top half of a double elliptic spring.

Four claims.

No. 649,719—Pneumatic Tire for Vehicles.—C. E. Duryea, Peoria, Ill., assignor to the Indiana Rubber & Insulated Wire Co., Marion, Ind. May 15, 1900. Application filed March 13, 1893.

No. 649,720—Pneumatic Vehicle Tire.—C. E. Duryea, Peoria, Ill., assignor to the Indiana Rubber & Insulated Wire Co., Marion, Ind. May 15, 1900. Application filed Aug. 24, 1894.

## BRITISH PATENTS.

Ignition Devices for Internal Combustion Engines.—Thomas, Edward and Lawrence Gardner, all of Barton Hall Engine Works, Patricroft. Patent No. 6,865 of 1899.

This invention, which relates to electric ignition devices for internal combustion engines, is shown by the accompanying illustrations, Figs. 1 and 2. Referring to these, A is the ignition chamber, in which is fitted the tubular bush B and liner C. In the latter is mounted the sliding ignition spindle D. This spindle and the bush B form the terminals of an electric circuit which, when in contact, complete the circuit. Insulating material, G, however, is fitted between them to hold them out of contact, except when the arms E on the ignition spindle come in contact with the wings F on the bush B. A spring, H, is mounted on the ignition spindle to resist or retard any lateral or rotary movements of said spindle, and to return it to its normal position for and after each ignition. The normal position of the ignition spindle is with the arms E clear of the wings F, but immediately the spindle is pushed inward the arms strike and (under the torsion of the spring) rub against the inclined edges of the wings F and thereby complete the electric circuit. When the spindle is allowed to resume its normal position under the longitudinal extension of the spring the effect of the arms E leaving the inclined edges of the wings F is to break the electric circuit and thereby create the desired sparking for exploding the combustible mixture in the engine. The making and breaking of contact between the arms E and wings F are effected by means of an insulated trip lever, I, operating under the impulses of a rod, J, coupled to the mechanism K for operating the admission valve L. Upon the rod J and upon the trip lever I are small abutment plates, M and N. Under the movement of the rod J in the direction of the arrow the plate M comes in contact with the plate N, and by such contact and the further movement of the rod in the same direction the lever I is caused to rotate on its axis and to push the spindle into the ignition chamber and complete the electric circuit. At a predetermined moment (according to the adjustment of the plates M N), and with the further inward movement of the rod J, the plate M (due to a rising arm of the trip lever lifting the rod) slips its abutment with plate N, and, releasing the trip lever, allows the spindle D, under the torsion and extension of the spring, to resume its normal position, and in so doing break contact with the wings F and effect the desired sparking for igniting the charge.

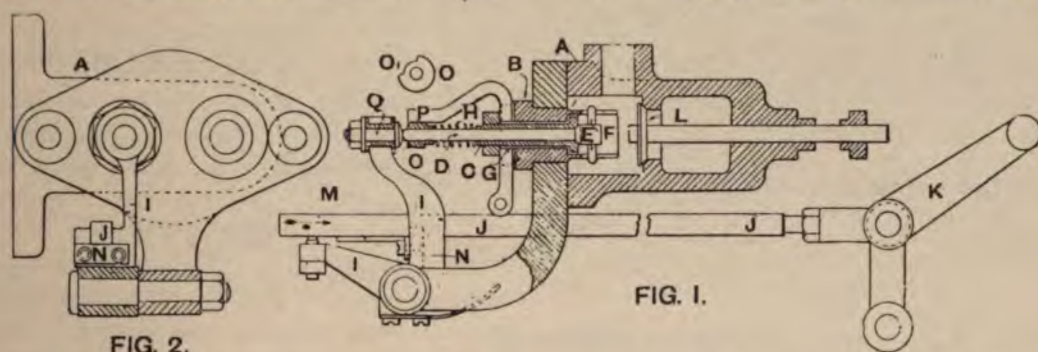



FIG. 2. FIG. I.



Gas and Oil Engines.—The Compagnie des Moteurs Duplex, of 130 Rue Lafayette, Paris. Patent No. 24,863 of 1899.

Figs. 1 and 2 show sectional views of an oil engine, working on the four-stroke cycle principle, constructed in accordance with this invention. Referring to the illustrations, A is the cylinder, B the main shaft, C the crank or gear casing which is hermetically closed, D the base of the motor. As will be seen, the base forms a reservoir, $D_1$, for the liquid hydrocarbon, and has a partition wall which forms another chamber, $D_2$, serving as an exhaust chamber, so that a portion of the exhaust heat may be utilized for heating beforehand the fuel contained in the chamber $D_1$. The casing C is provided with an air admission valve, $C_1$, and a discharge valve, $C_2$. A pipe, $C_3$, conveys the air from this valve $C_2$ into the reservoir $D_1$. When the gear casing is closed the alternating movement of the piston produces in the casing and the adjacent part of the motor cylinder a pumping effect, by which the air admitted through the valve $C_1$ is forced through the non-return valve $C_2$ and the pipe $C_3$ into the chamber $D_1$.

FIG. 1.

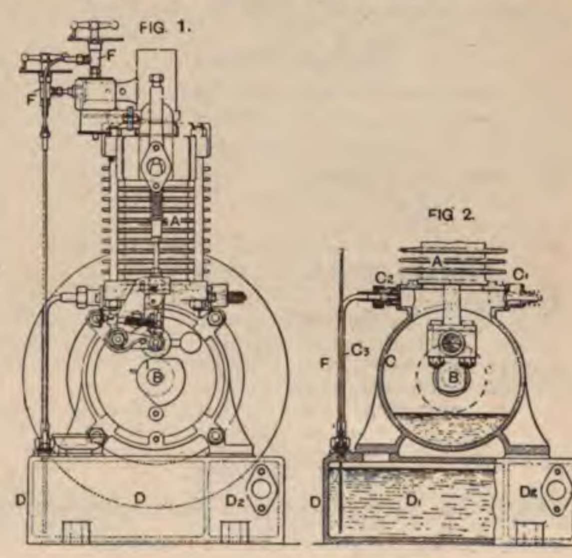



FIG 2.

Thus, when the machine is working a pressure is produced above the surface of the liquid which is substantially constant and sufficiently high to force the liquid through the pipe $F_1$ into the carbureter F (Fig. 1). The distributing device is operated by means of the cam I keyed directly to the main shaft B. The governor acts upon the movement of the motor by leaving the exhaust valve lifted during the period of suction, so that instead of drawing in an explosive mixture the motor only draws in air.

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# Facts About Storage Batteries.

BY ISAIAH L. ROBERTS.

OTHER INFORMATION ON THIS SUBJECT BY WELL-KNOWN EXPERTS CONTAINED IN OUR

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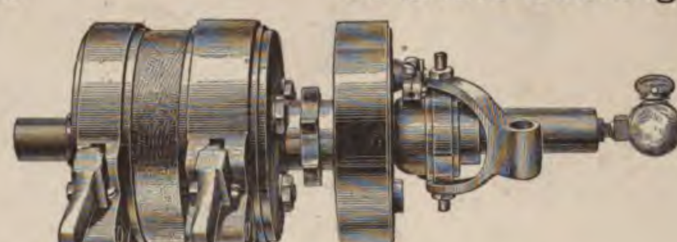

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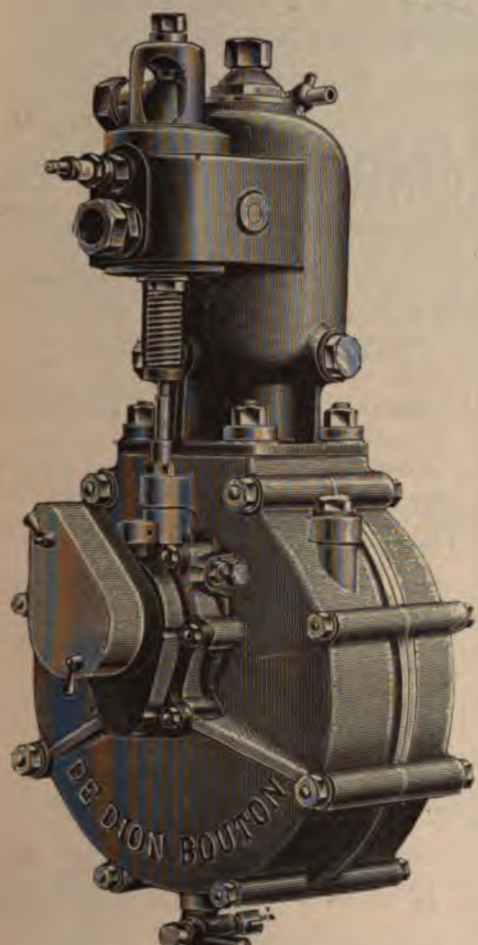


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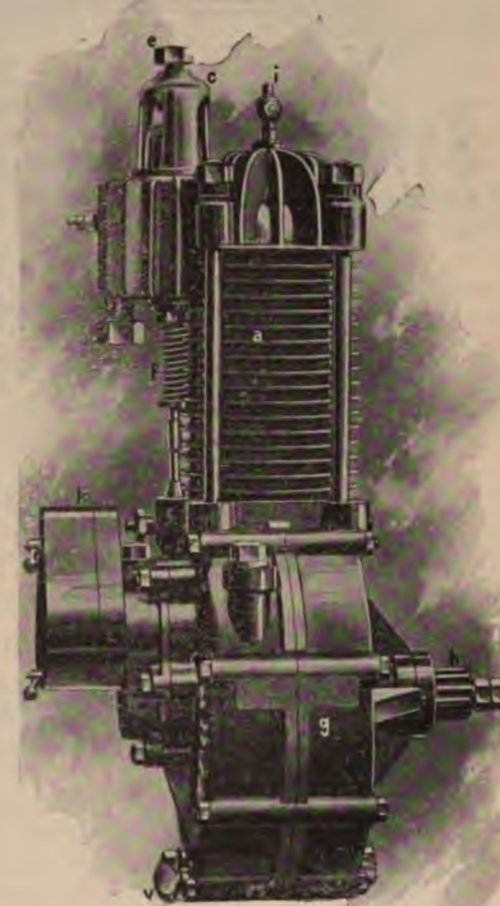

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EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. VI. NEW YORK, MAY 30, 1900. No. 9.



## THE HORSELESS AGE.

**E. P. INGERSOLL, Editor and Proprietor.**

PUBLICATION OFFICE:
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HERBERT LADD TOWLE, Associate Editor.

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COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

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**Entered at the New York post-office as second class matter.**


**On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.**

The Acetylene Motor Number, to appear June 20, will contain, among others, articles on "Acetylene and Alcohol Versus Gasoline as Fuels," by T. L. Roberts, and "Will Acetylene Be the Coming Power for Motor Vehicles?" by D. N. Long.

## In the Matter of Tests.

Fifty-one motor cars, out of sixty-odd starters, completed the 1,000-mile trial of the Automobile Club of Great Britain. There were eleven actual running days, on seven of which the distance covered was over 100 miles. One-day exhibitions were held at seven towns en route, and briefer exhibitions at six others. Public interest all along the road was intense; the streets of cities and villages were lined with people who watched for hours as the irregular procession (there was no attempt at close order in running) straggled by, and the exhibitions were attended by throngs.

About a score of the finishers were voiturettes or motor cycles, and the endurance of these little machines, hanging on the trail of the princely Panhard, Benz, Daimler and Napier cars, was one of the unexpected features of the trial. Minor break-downs were numerous, some cars getting much more than their share, while others escaped almost scot-free; but nevertheless it was demonstrated of many, at least, of the "small fry," that they were capable, if not precisely of rivaling the army mule in their ability to endure anything, yet of essaying much more than park service. Making all possible allowance for the experience of the drivers, the moderate speeds, the good roads and the excellent management, the trial lately ended brought home to the British public better than anything else could have done the fact that the motor vehicle is destined to be, and is already, a thing for practical service, and not merely the hobby of mechanical cranks or the fad of sporting men.

Naturally, with the British event so fresh in mind, the question will occur to those who read the letters of Mr. Chamberlain and Mr. Field, of the American organization, which we publish in another column, whether some such thing might not be attempted in this country. Motor vehicle tests may be of various sorts, according to the particular qualities which it is desired to demonstrate. A race is, of course, the most obvious, as a competitive test of speed. But there are many features besides speed demanded of a commercial vehicle, which merit attention commensurate with their importance. Economy of maintenance and operation, durability, reliability, simplicity—so far as compatible with functional completeness,—hill-climbing powers, perfect manageability as a pre-requisite to high speed, comfortableness and ease of control, are some. Many of them rank higher than speed, and all are more difficult of attainment. But no test can be representative which ignores them, and a test directed at some and not at others is liable to result in the sacrifice of the features slighted, in order to obtain better results in those at issue. Such a test necessarily conveys a wrong impression to the public, and is of little value to the trade.

The first competitive tests in this country were in the nature of races. None of the contesting vehicles was out of the experimental stage, and the events fell rather flat, owing to the

failure of most of the contestants to cover the course. More recently tests in manœuvring have been held, with much success. But the complete and all-round test is yet to be devised, and The Horseless Age hopes to see the feasibility of it agitated, at least, in the present connection. It is probably too soon to talk of 1,000-mile runs to settle the single question of endurance, but it would seem that the time has come for something more than a circus-ring test of an hour or two at a time.

## For Competitive Tests.

The Horseless Age has received the following letters, which speak for themselves:

New York, May 5.

C. J. Field, Brooklyn, N. Y.:

Dear Sir.—It is the wish of the board of governors of the Automobile Club of America that there should take place a series of trials or competitive tests under the auspices of the technical committee, of which you are chairman.

I am therefore authorized to ask you, as soon as convenient, to inaugurate one or more of these competitions, to take place in the open air, in some convenient section of New York.

The main feature of these proposed tests to comprise the stopping, turning, avoidance of obstacles, etc., on different road surfaces, and also in competition with horse-drawn vehicles, the idea being to obtain from such series of tests valuable data regarding the rates of speed which can safely be allowed for various types of automobiles.

It is also suggested that the tests be classified, and each vehicle be entered in its respective class.

The governors wish to leave all the details and, in fact, the entire matter in your charge, authorizing you to select your own time and employ such means as in your judgment will best accomplish the results. Very truly yours,

GEO. A. CHAMBERLAIN,
Acting Prest. A. C. A.

New York, N. Y., May 10.

Dear Sir.—Acting under the direction of the board of governors, the technical committee is preparing the details for a series of trials and competitive tests, which are intended to develop the strong features in turning, stopping, avoidance of obstacles, hill climbing and other various manœuvres, which will develop the strong points of each one of the different types of automobiles, and also comparative ones in competition with horse-drawn vehicles, the idea being to make this an interesting and instructive series of tests for the benefit of the club members and the public at large, and also to develop the question of safe speeds for the different types of automobiles.

The chairman of the technical committee, C. J. Field, 1294 Dean St., Brooklyn, N. Y., asks as a special favor that all the members of the club give their thought to this matter, and any ideas which they have on the matter to kindly forward to him at the above address about the middle of June.

This is about the time Mr. Field will return from his trip abroad, and the committee proposes to take the matter up at that time to formulate rules and regulations in the matter and issue them for the information of the club members during the month of July.

It is proposed to hold these tests at some place in New York City during the early fall.

Your hearty co-operation in the matter in making suggestions and also arranging to take part in them will materially aid in making these trials what we believe they should be—one of the most successful and important features of our work this year. Respectfully yours,

C. J. FIELD.
Chn. Technical Committee, A. C. A.

## The Gas Engine Hot Tube as an Ignition Timing Device.*

By Wm. T. Magruder, Columbus, O.

The series of tests of a gas engine, data and results of which it is here desired to record, was made as part of the regular post-graduate laboratory work given by the writer, in gas enginery, at the Ohio State University at Columbus, O., during the college year 1898-9, by F. J. Hale, M. E., class of '98, and Horace Judd, M. E., class of '97, as part of their elected work for their post-graduate degrees. Mr. Hale had previously assisted in making over 50 tests of gas engines, under 80 h.p. in size; while Mr. Judd had been for more than a year an assistant in the mechanical engineering laboratory. Both young men were unusually painstaking and careful observers, and it is therefore thought that the data and results are trustworthy. Most of the indicator diagrams here presented were taken by the writer. The results have been worked up chiefly by Mr. Hale, and have been checked by the writer and one of his students.

The engine tested was rated at 9 i.h.p., and at 7 b.h.p. when using natural gas and running at 280 revolutions per minute. It may be classified as a 4-cycle, scavenging, horizontal gas engine having a single cylinder 6-in. diameter and 12-in. stroke. The lay shaft was driven by spiral gears from the crank shaft at one-half the latter's number of revolutions per minute. Cams on the lay shaft caused the inlet and exhaust valves to open once in every 2 revolutions of the crank shaft. The governor was the usual type of hit-or-miss, inertia, pendulum governor actuated by a cam on the lay shaft, and propelled by a spring; and hitting or missing, as the work and the speed of the engine demanded, a tappet on the end of the gas inlet valve spindle whereby gas was admitted to the mixing chamber, whence the mixture of gas and air, or the air alone, passed through the inlet valve into the ignition chamber and so into the combustion chamber, or cartridge space, of the engine cylinder.

About 25 tests of this engine had been made during the preceding college year, so that it is thought that the newness of the engine had been worked off, and that both valves and journals had become adjusted in their bearings.

The method of testing was the usual method employed in this laboratory of testing gas engines. A full description of the gas-engine testing plant may be found in Vol. VII., page 122, of the Proceedings of the Society for the Promotion of Engineering Education, in a paper presented to the society by the writer at its Columbus meeting, in 1899, on "The Hydrocarbon-Engine Testing Plant of the Ohio State University." For the purposes of this paper, however, it should be stated that the power gas for a test is collected in a gasometer of 225 cu. ft. capacity, which is graduated into cubic feet, and so that readings may be easily estimated to one-tenth of a cubic foot. From the gasometer the power gas is forced by city water pressure to the engine through an ordinary tin gas meter, whose readings are used solely for the purpose of checking. The pressure of the power gas is measured by a water manometer connected to the gasometer, and is regulated by the observer, who is stationed at the water inlet valve. By this

* Read before the American Society of Mechanical Engineers, Cincinnati, May, 1900.

means almost any desired pressure may be obtained. The power gas pipe leading to the engine is 1½ in. in diameter, while the engine's gas cock was ¾ in. The air inlet of the engine was tapped for 1½-in. pipe, into which was connected a 1½-in. close nipple, a 1½-in. by 2-in. reducer, a 2-in. close nipple, and then a 2-in. malleable iron pipe union, so that the air of the room entered the engine through these fittings in the reverse order to that here given. In order to regulate or throttle the air supply, circular orifices made with sharp edges in thin planished iron were inserted between the two halves of the 2-in. pipe union.

The gas for the Bunsen burner of the hot tube was taken from the main and measured by a separate 5-light tin meter, and had no relation to the power gas except that it came from the same street main.

The exhaust gases passed by a 2½-in. pipe through the usual exhaust pot, and so by a 2½-in. pipe to the atmosphere.

The jacket water entered the cylinder jacket below the combustion chamber, and passed out above at the front end of the cylinder. Its temperatures were measured by chemical thermometers whose bulbs were immersed in cylinder oil in thin-walled brass thermometer cups inserted in pipe fittings through which the jacket water was passing. The engine was so piped that the jacket water could be weighed either before or after it had passed through the cylinder of the engine.

No attempt was made in this series of tests to measure the quantity of air consumed, although ample facilities were at hand, as a previous series of 25 tests had been made on this point and tests made with the engine receiving air from 4 in. of pressure to 19 in. of suction. Neither were the exhaust gases analyzed. The gas used was ordinary Columbus coal gas. Its composition is accepted as reported below by the analysis of a sample made by Frank Haas, C. E., E. M., of the department of metallurgy of the university, and under the direction of Prof. N. W. Lord, E. M.

ANALYSIS OF GAS.

| | |
|---|---|
| Illuminants ($C_2H_4$) | 7.7 per cent. |
| $CO_2$ | .4 per cent. |
| O | 2.4 per cent. |
| CO | 5.3 per cent. |
| H | 50.5 per cent. |
| N | 9.0 per cent. |
| $CH_4$ | 24.7 per cent. |
| | 100.0 per cent. |

Its calorific value, as determined from this analysis, is 584 British thermal units per cubic foot of the gas at 32 degs. Fahr., and at standard barometric pressure (29.92 in. of mercury). Its calorific value, as determined by these chemists in the Mahler bomb calorimeter of the department of metallurgy, is 564 British thermal units per cubic foot of gas under the same conditions.

The indicated horse-power was obtained by means of a new Crosby gas engine indicator and an "Ideal" reducing motion, which received its motion from a stout iron arm rigidly secured to the piston of the engine. The straight indicator cock was screwed directly into the top wall of the combusion chamber. The brake horse-power was obtained by a rope brake resting on a pair of double-beam platform scales, and whose rope encircled a water-cooled brake pulley. The revolutions of the lay shaft and the admissions of gas per minute were obtained by electric counters, either or both of which could be thrown into or out of action by the observer at the gasometer, and also at a place nearer to the engine.

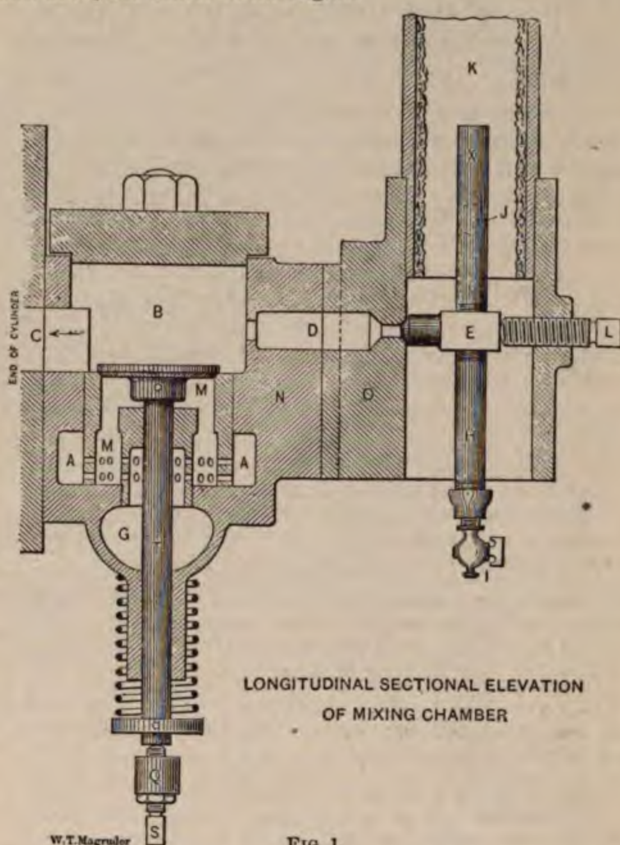



FIG. 1.

In the accompanying illustrations Figs. 1 and 2 represent longitudinal and cross-sectional elevations of the mixing and ignition chambers. Referring to the figures, the gas enters the engine through a ¾-in. stop cock, whose pointer handle, W, rotates over a dial, P, graduated from zero to ten. When the hand is at zero the cock is closed, and when at ten is wide

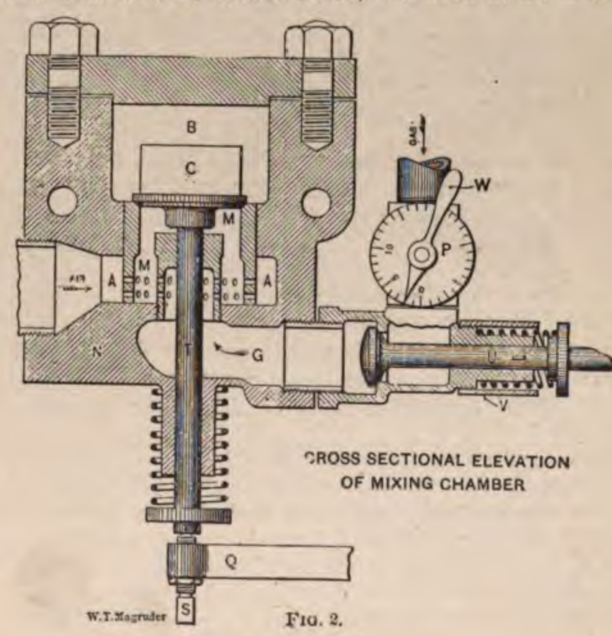



FIG. 2.

open. When the load is increased and the speed is decreased, the inertia pendulum governor strikes the tappet on the right hand end of the gas inlet valve U, causing it to open to an extent that can be regulated by the thimble V. The gas thus enters the space G, and passing through the holes, as shown, mixes with atmospheric air, which has come in by way of the 1½-in. air pipe into the air chamber A, whence it, too, passes through numerous small holes so as to cause an intimate commingling of the gas and air in the mixing chamber M.

Once in each two revolutions, a cam on the lay shaft actuates the lever Q, and, through the "inlet valve lever set screw" S, causes the valve T to rise and so permit the mixture of gas and air, or of air alone, to enter the ignition space B. Here the fresh gases mix with the burnt gases of the preceding stroke, and fill the ignition chamber B, the inlet C and the combustion chamber and cylinder volume, during the suction stroke of the piston. The passageway D to the hot tube, being, as it were, a dead end, remains filled with the burned gases of the preceding stroke.

The ignition chamber B is formed in a casting, N, bolted to the end of the engine cylinder, so as to have direct communication with it through the rectangular inlet C. On the outside of the ignition chamber casting N is bolted the casting O, in which is fastened by set screw L the hot-tube tee E, which is connected to the passageway D by a hole ¼ in. in diameter. Into the tee E is screwed the hot tube proper X, having a solid end, and also the lower hot tube H, made of ¼-in. gas pipe, and having on the end a ¼-in. by ⅛-in. reducer, and the "lower hot-tube pet cock" I. This pet cock I originally contained a hole 1-64 in. in diameter, but was replaced in certain of the experiments by an ordinary ⅛-in. pet cock. The upper hot tube X was surrounded by an asbestos-lined cast-iron chimney K, through which the tip J of the Bunsen burner projected, so that the flame could play upon the upper hot tube at a point about 1½ in. above the tee E. It will thus be seen that ignition was effected in this mechanism by compressing the burnt gases which were left in the passageway D, the tee E, and the upper and lower hot tubes X and H, into the lower hot tube H, and the upper portion of the upper hot tube X, so that the mixture of fresh gas and air followed and came into contact with that part of the upper hot tube which was red hot, became ignited, and, striking back through the tee E, passageway D, ignition chamber B and inlet C, caused the ignition of the large volume of the compressed gas and air in the combustion chamber of the engine, and so caused the piston to make a power stroke.

The exhaust valve was opened by a lever operated through a roller actuated by a cam on the lay shaft. The roller was journaled on an eccentric stud in the lever, and so arranged that it could be rotated so as to cause the exhaust valve to always remain open a small amount, and, by thus creating a leak at the exhaust valve, decrease the compression and so make the starting line of the engine easier. When the tee-handled end of the eccentric was vertical, the exhaust valve was closed and kept closed by its spring; but when the handle was horizontal, the exhaust valve could not close and therefore leaked.

Early in the experimenting with this engine, under the unusual conditions imposed, it was discovered that the time of ignition was a variable depending upon quite a number of different conditions, and that before any accurate and scientific data could be collected or any satisfactory results could be obtained, these conditions must be individually and systematically studied. To do this intelligently, the following schedule of conditions was assigned, and tests made in which, as far as possible, only one condition at a time was allowed to vary.

The variable conditions upon which the time of ignition was assumed to depend were:

1. The length and diameter of the upper hot tube.
2. The length and diameter of the lower hot tube.
3. The volume of the passageway D.
4. The amount of compression due to the percentage of piston displacement in clearance volume.
5. A leak at the lower hot tube pet cock I.
6. A leak by the piston rings.
7. The position of the inlet valve lever set screw.
8. Whether the exhaust valve leaked or not; that is, whether the starting cam handle was vertical or horizontal.
9. The temperature of the jacket-water outlet.
10. The temperature of the mixing and ignition chambers.
11. The speed of the engine at constant jacket-water outlet temperature.
12. The temperature of the hot tube.
13. Whether the previous stroke had been missed or not.
14. The pressure of the gas.
15. The position of the gas-cock handle.
16. The size of the air-inlet diaphragm.
17. The pressure, or suction, at which the air was delivered to the engine.

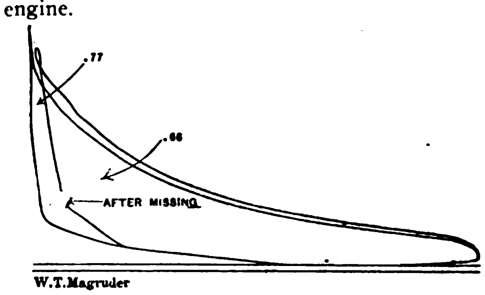



FIG 4.

Run No. 136. Date Nov. 12, 1898. Time 11:39 A.M. No. 8. Spring 200. Length 2.46. Area .77 and .66. R.P.M. 290 1-3. X.P.M. 42.2. M.E.P. 75.10 and 64.39. I.H.P.——. 1¾-in. Inlet Air Orifice. 5½-in. Hot Tube.

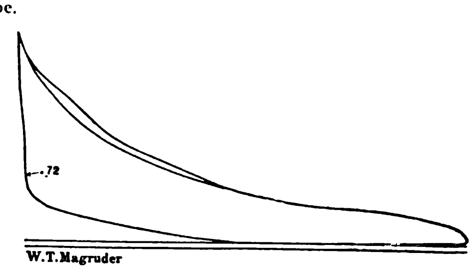



FIG. 5.

Run No. 129. Date Nov. 5, 1898. Time 10:45 A.M. No. 8. Spring 200. Length 2.47. Area .72. R.P.M. 274. X.P.M. 115. M.E.P. 69 to 96. I.H.P.——. 1¾-in Air Orifice. 4-in. Hot Tube.

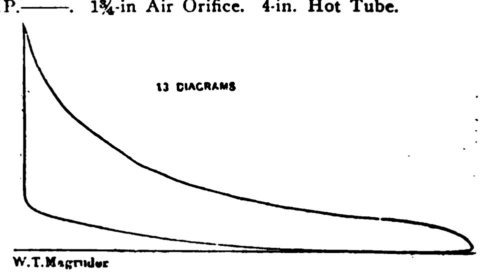



FIG. 7.

Run No. 140. Date March 11, 1899. Time 9:52 A.M. No. 4. Spring 240. Length 2.42. Area .74. Average R.P.M. 240.6. X.P.M. 118.43. M.E.P. 73.39. I.H.P.——. 3½-in. Hot Tube. 2-in. Air Orifice.

I. THE LENGTH OF THE UPPER HOT TUBE.

From what has previously been said, it is evident that the greater the volumes of the spaces in the upper and lower hot tubes, either or both, the greater will be the amounts of the burnt gases which they will contain, and therefore the sooner will the fresh gases reach the red hot part of the upper hot tube. Consequently, the longer the upper hot tube, the earlier will be the ignition. Fig. 4 shows this for an upper hot tube 5½ in. long. Fig. 5 shows this for an upper hot tube 4 in. long, and Fig. 7 for a 3½-in. upper hot tube. Fig. 9 shows this for a 2¾-in. hot tube. Figs. 12 and 13 show this for a 2-in. hot tube, and also the variation in the time of ignition due to so short a hot tube.

2. THE LENGTH AND DIAMETER OF THE LOWER HOT TUBE.

From what has been said under the first condition, it will be quite apparent that the greater the volume of the lower hot tube (that is, the greater its length for a given diameter, or the greater its diameter for a given length, or both), the earlier will

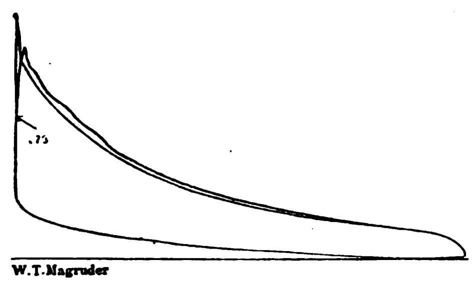
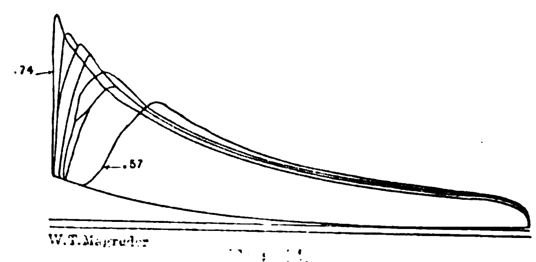



FIG. 9.

Run No. 139A. Date Feb. 17, 1899. Time——M. No. 4. Spring 240. Length 2.47. Area .70 and .73. R.P.M. 280. X.P.M.——. M.E.P. 68.02 to 70.93. I.H.P.——. 2¾-in. Upper Hot Tube. 2¾-in. Lower Hot Tube.




Run No. 139A. Date Feb. 17, 1899. Time——M. No. 1. Spring 240. Length 2.45. Area .74, .57, .55, .84. R.P.M. 280. X.P.M.——. M.E.P. 72.49. I.H.P.——. 2¾-in. Upper Hot Tube, 1¼-in. Lower Hot Tube.

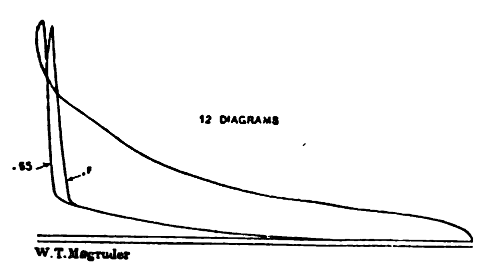



FIG. 12.

Run No. 139. Date Jan. 31, 1899. Time 3:45 P.M. No. 7. Spring 240. Length 2.43. Area .55 and .50. R.P.M.——. X.P.M.——. M.E.P. 54.32 and 49.38. I.H.P.——. Lower Hot Tube.

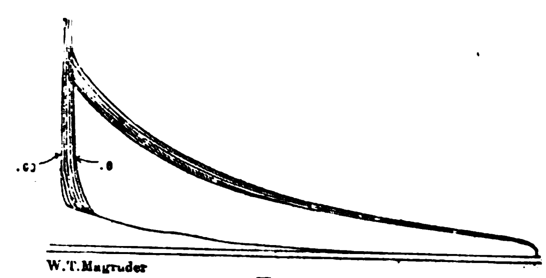



FIG. 16.

Run No. 139A. Date Feb. 17, 1899. Time——M. No. 17. Spring 240. Length 2.48. Area .69 to .60. R.P.M. 280. X.P.M.——. M.E.P. 58.06 and 66.78. I.H.P.——. 2¾-in. Upper Hot Tube. 8¼-in. Lower Hot Tube.

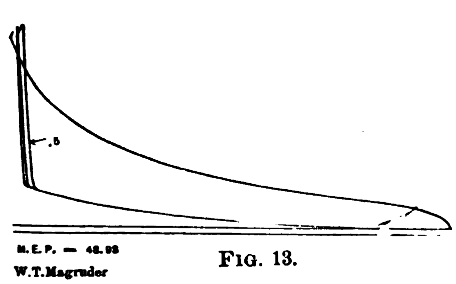



FIG. 13.

Run No. 139. Date Jan. 31, 1899. Time 3:48 P.M. No. 8. Spring 240. Length 2.45. Area .5. R.P.M.——. X.P.M.——. M.E.P. 48.98. I.H.P.——.

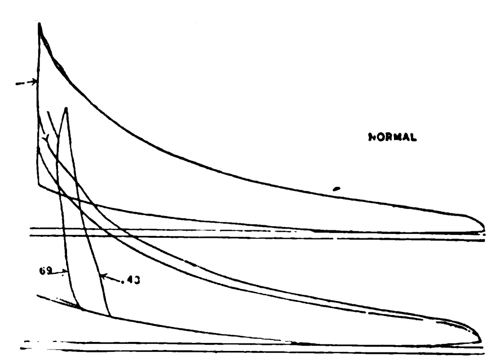



FIG. 18.

Run No. 156. Date April 1, 1899. Time 9:19 A.M. No. 3. Spring 240. Length 2.45. Area .70 to .43. R.P.M. 265. X.P.M. 115. M.E.P. 68.57 to 42.12. I.H.P.——. 110 lbs. Net Brake Load. 100° F. J.W. Outlet.

be the time of ignition. This, it is thought, is clearly shown by the diagrams from Run 139 A, where the length of this tube was changed from 1¼ in. with Fig. 14, to 8¼ in. with Fig. 16, while the upper hot tube remained constantly 2¾ in. long. Therefore, the longer, or larger, the lower hot tube, the earlier will be the ignition.

3. THE VOLUME OF THE PASSAGEWAY D.

No means were available to prove this condition, but it would seem quite evident that the larger the volume of the passageway D the larger would be the volume of burnt gases for which

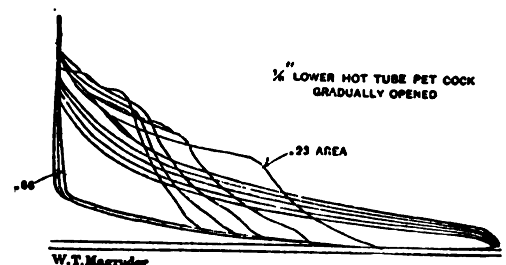



FIG. 23.

Run No. 156. Date April 1, 1899. Time 10:46 A.M. No. 27. Spring 240. Length 2.44. Area .66 to .23. R.P.M. 260. X.P.M. 130. M.E.P. 64.92 to 22.62. I.H.P.——. 115 lbs. Net Brake Load. 100° F. J.W. Outlet.

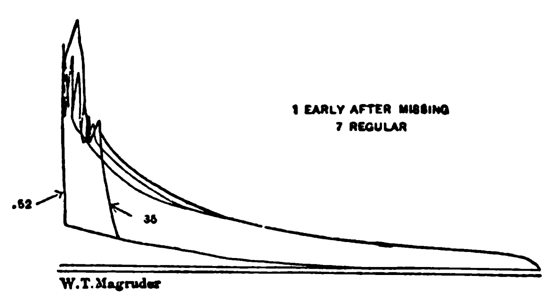



FIG. 24.

Run No. 159. Date April 5, 1899. Time 2:31 P.M. No. 2. Spring 240. Length 2.45. Area .52 to .35. R.P.M. 260. X.P.M. 120. M.E.P. 50.94. to 34.29. I.H.P.——. 3½-in. Hot Tube.

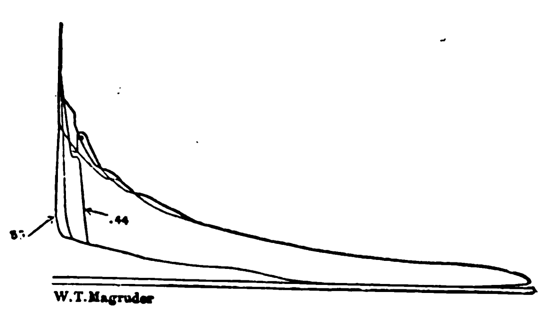



FIG. 25.

Run No. 159. Date April 5, 1899. Time 2:32 P.M. No. 3. Spring 240. Length 2.45. Area .55 to .47. R.P.M. 260. X.P.M. 120. M.E.P. 53.88 to 46.04. I.H.P.——. 3½-in. Hot Tube.

room would have to be found in the upper or lower hot tubes before the fresh gases could become ignited. The logical conclusion would therefore seem to be that the larger the passageway D the later would be the ignition.

4. THE AMOUNT OF COMPRESSION DUE TO THE PERCENTAGE OF PISTON DISPLACEMENT IN CLEARANCE VOLUME.

With this engine no facilities were available for either increasing or decreasing the volume of the combustion chamber, and thereby changing the percentage of clearance volume, which was 33.99 per cent. of the piston displacement. But it is evident that with a larger combustion chamber the compression will be lower, and the volume into which the burnt gases of the passageway D, etc., will be compressed will be larger, and therefore, the greater the clearance volume and the lower the compression, the later will be the ignition, and vice versa.

5. A LEAK AT THE LOWER HOT TUBE PET COCK I.

From Figs. 18 and 23 of Run 156, it is evident that a leak at the lower hot tube pet cock (or at where the tubes H and X are screwed into the tee E) will allow the burnt gases in the passageway D to be exhausted into the air, and thereby cause a very early ignition.

6. A LEAK BY THE PISTON RINGS.

Run 159 was made to determine the result of running without the four piston rings being in their usual place. The leak of burnt gases from the front end of the cylinder was very perceptible. The compression was reduced from the usual 60 lbs. to about 48 lbs., and the average mean effective pressure

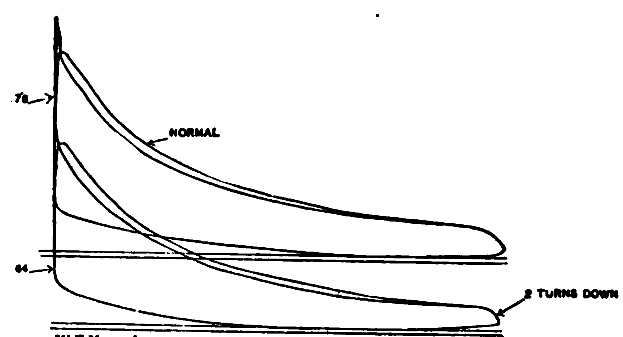



FIG. 28.

Run No. 146. Date March 14, 1899. Time 4:46 P.M. No. 10. Spring 240. Length 2.46. Area .76 to .64. R.P.M. 266. X.P.M. 129. M.E.P. 74.16 to 62.44. I.H.P.——.

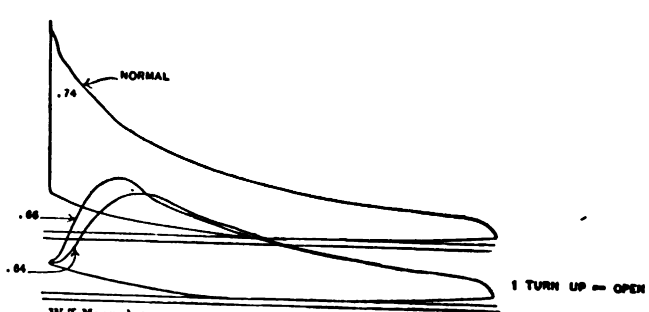



FIG 29.

Run No. 146. Date March 14, 1899. Time 4:38 P.M. No. 6. Spring 240. Length 2.45. Area .74 to .64. R.P.M. 266. X.P.M. 129. M.E.P. 72.49 to 62.69. I.H.P.——.

was reduced from 75 or 80 lbs. to 48 lbs., except after missing a stroke. Figs. 24 and 25 show that ignition took place exactly on the dead center with a hot tube 3¼ in. long. It would therefore seem that the omission or breakage of one or more piston rings, while affecting the compression, mean effective pressure and the indicated horse-power, will have practically but little effect upon the time of ignition.

7. THE POSITION OF THE INLET VALVE LEVER SET SCREW S.

This set screw S caused the inlet valve to open at the beginning of the suction stroke. The spiral spring surrounding the spindle of the valve caused the valve to seat itself as soon as the motion of the set screw would permit. By lowering the set screw, it is evident that the valve was opened later and closed earlier, and the result on the engine was a decrease in speed. By raising the screw, thereby preventing the valve from spring-seating, the ignition was made much later and the speed of the engine decreased from 266 revolutions per minute to 200 revolutions per minute. On these cards the word "normal" refers to the diagram which was taken under normal conditions, either just before or after making the special diagram, and was taken to make the comparison more marked. Fig. 28 shows the effect of turning down the inlet valve lever set screw, while Fig. 29 shows the effect on the time of ignition and the areas of the cards of turning it up. When turned up one turn, the inlet valve was never allowed to close tightly.

(*To be Concluded.*)

The campaign against automobile scorchers in Paris is being carried on relentlessly. One day lately there were 42 arrests for this cause alone. The fines so far have been light, the purpose seeming to be to repress rather than to punish the offenders. The licenses issued to chauffeurs are graded according to the speed permitted, some expert operators being allowed carte blanche, while others are narrowly restricted in this regard.

## Motor Vehicle Ideas Compiled.

In a recent issue we noticed a pamphlet on the legal status of the motor vehicle, written by Fred D. Stanley, of Boston. We have just received the larger publication of which the above brochure originally formed a chapter. This is entitled "The Motor Vehicle Industry," and is a collection under one cover of numerous articles on the history, development, economic features and motive power of these vehicles, which articles have appeared partly in the technical and partly in the daily press during the past year, in both this country and England. Numerous brief semi-technical articles are given on the relative merits and cost of the different motive powers, some theoretical and some from actual tests. The book is not intended for specialists, but for the information of the public, and in this regard it fills a gap of long standing. The compiler is W. A. Whittlesey, of Boston.



# LESSONS of the ROAD

## Another Steam Carriage.

Editor Horseless Age:

I was very much interested in the story and your editorial comments anent the tribulations of a steam machine. I have one of the same make and have had pretty much the same experience. When I found my boiler leaking I took off the burner and found every tube but one wet. I turned a steel punch with very little taper and made a little set in this shape:

(See sketch.) I would drive the punch pretty firmly in a tube and with light taps curl the end of the tube over all around with the set punch. I found it unnecessary to take the boiler off. I merely tipped the carriage over on its side. For the wind blowing the fire back and out I put a sheet of asbestos paper over the hole where I pour water in. I find it very easy to use more than twice the amount of gasoline necessary. I can, by keeping the boiler over half full, use much more than the required amount of water and not get as good results. For lighting I use a small spark coil 8 in. long, with a bundle of iron wire 1 in. in diameter. For a core wound ¾ in. thick with No. 18 magnet wire, I use two "Mesco" dry cells of battery and connect one pole to the coil and the other to the burner. The other wire from the coil is long enough to stick into the firebox and scratch against the metal, which produces a spark. I really think the steam rig is the best thing on the market. I have only one objection to my steam carriage but that will probably force me to trade it for a gasoline rig. I need a carriage that I can run onto a boat and make the power run the boat; and the United States marine laws will not allow me to run a boat with the steam engine that is on the carriage. The two Mesco dry cells run the igniter and a bell, and lamps at steam and water gauges, also a flash road lamp, so they are quite a convenient thing to have along.

STEAM CARRIAGE NO. 2.

# COMMUNICATIONS.

## The Packing Abolished—Engine Power.

Buffalo, N. Y., May 15.

Editor Horseless Age:

I will give a couple of my experiences, which may be useful to "One of the Cranks," who writes in The Horseless Age of May 9.

I have used a storage battery of two cells successfully, and have not been troubled much with the slopping of the acid.

As to the packing of the cylinder head, I learned from experience that packing of any kind was troublesome, and so I turned and ground a projection ¼ in. long on the head

to fit into the cylinder, besides the fit on the end of the cylinder, which was ground also. A little shellac on both fits helps. I use six ⅜-in. studs on a 4 x 5 in. engine, and have had no trouble from that source. My practice as to the lead of the spark is about the same as "One of the Cranks" describes.

I should like to know at what speed his engine pulls best; also the amount in foot-pounds. I can get 2 h.p. out of a 4 x 5 in. at 550 revolutions per minute, with cold gasoline. I have not tested it since I put a heating tube through the tank, but notice a difference and think it is doing better.

Is this good, bad or indifferent?

GEORGE B. BOWEN.

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Ozone Park, L. I., May 13.

Editor Horseless Age:

No wonder "One of the Cranks" is disgusted with the "sloppy wet batteries;" and I hardly know of a dry battery that is reliable for any great length of time. As to his cylinder head packing, I would suggest that he discard all packings, simply scraping the surfaces to a fit and luting them lightly with red lead and oil, and twisting them back and forth a few times to get them to a good bearing, and screw up tightly. The six screws, if the head should be a little light, might not be sufficient, as they would be about 3 in. apart. If so, put in six more between them, which might be smaller—say ⅜ in.—and I think he will be free from the head difficulty. A. S. MUNGER.

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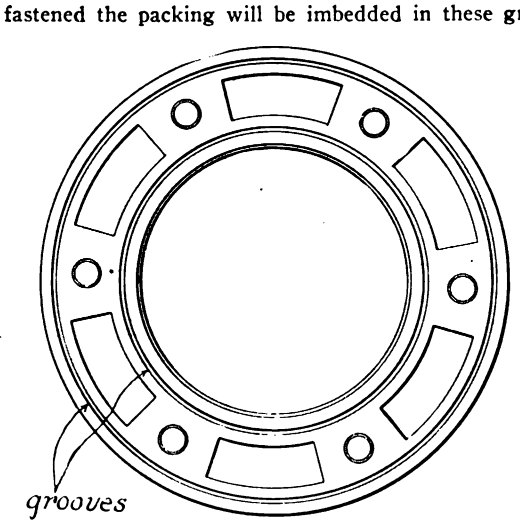
## Another Way.

Clinton, Mo., May 16.

Editor Horseless Age:

In answer to "One of the Cranks" regarding his trouble with cylinder head packing, I will say that I have had practically the same trouble, and overcame it by cutting grooves in the outer and inner cylinder walls, so that when the cylinder head is well fastened the packing will be imbedded in these grooves.




This aids materially in holding the packing. I find no packing better than asbestos 1-32 in. thick. Six ½-in. cap screws I think sufficient, as I have no trouble with six ⅝-in. studs on a 7-in. by 9-in. with 100 lbs. compression. As I have taken no cards from this engine as yet, I cannot say what is the exact explosion or maximum pressure. C. M. MOHLER.

## Taste and Economy.

Reading, Pa., May 19.

Editor Horseless Age:

Your editorial on "Some Questions of Taste" was read by the writer with interest, and he, having been designing motor vehicles since 1891, wishes to excuse designers for some things they do and to show why many things about a motor vehicle are done. Our first designs were built to be commercial rather than artistic. They consisted of an ordinary horse phaeton with shafts removed and a motor placed on the running gear, sprockets being clamped to the rear wheels and driven by chains from countershaft. It is quite likely that this same fact—commercialism—influenced many other designers. By using horse vehicle forms they could use horse vehicle parts and save money, time and work by not designing and building something special when they could find regular parts that they could use in the open market. Vehicles of this type were certainly "horseless vehicles." They looked blunt and incomplete, and it is only because the public are getting accustomed to the makeshift that they are tolerated to-day. Such a vehicle is not a motor vehicle of the future. Increased experience demonstrated that many parts of the horse vehicle were not satisfactory and each new design of motor vehicle used less and less of the regular horse vehicle parts, besides which, modifications were introduced rendering the vehicle more efficient and (on the principle that "handsome is that handsome does") more beautiful.

Prof. Sweet's thought, "to the truly educated eye, whatever is right looks right," is proven truth aptly expressed, and is the key to all engineering design, as you truly say. The fault is that the public, not being educated upon motor vehicle design, do not know what is beautiful, and in their ignorance they can do no better than to compare a motor vehicle with its nearest relative—the horse vehicle. They unconsciously apply to motor vehicles the prevailing tests for style and beauty applied to horse vehicles, regardless of the fact that the conditions are widely different. They forget the high speed and heavy weight of the motor vehicle. They do not consider the dash as a wind shield instead of a mud shield. The steering problem never enters their heads, traction means nothing to them, while simplicity of machinery, accessibility of the mechanical parts, protection of the operator from grease and of the machinery from dirt appeal to them as being within the province of the hostler rather than a matter of concern to the operator.

As they learn more of motor vehicles they will appreciate the good points and be able to separate other lines of the two classes as they properly should be; and while this educating process is taking place the up-to-date motor vehicle builder who builds the most perfect motor vehicle his experience can suggest, must expect to be criticised and looked upon as a crank by those of less experience; and he must be willing to reap his reward in later years by seeing his forms adopted and his goods purchased when the public reach that point of sufficient education to know what is merit.

Your remarks should be taken to heart by every motor vehicle user, and we trust you will favor us with more of them.

CHAS. E. DURYEA.

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**ACETYLENE MOTOR NUMBER JUNE 20.**

# Poppet Valves—Cylinder Cooling—Back Explosions.

Editor Horseless Age:

I want to express my appreciation of the article on poppet valves in your issue of April 18. I think Mr. Berger has thrown a strong light upon a hitherto dark subject. Much has been done in reference to steam engine valves, with a considerable resultant increase in efficiency and adaptability. We can expect at least as much improvement from rational design in gas engine valves.

The following experience which I had some time ago makes me realize that it is important to take into account in fast running engines the time occupied by the valves in reaching their seats.

We wanted a supply of air compressed to 15 or 20 lbs. and did not have a convenient pump; but we did have a two-cylinder Daimler gas engine, which compressed its charge to about 60 lbs., so we proposed to run that with one cylinder and use the other for a pump. We removed the exhaust valve from one cylinder and substituted a rather heavy poppet valve, connected the exhaust port with a reservoir and set the engine running. The pressure of air in the reservoir went up to about 5 lbs. and stopped. The engine was running at its normal speed—600 revolutions per minute—everything seemed to be tight, and we could hear the valve working very distinctly.

I took out the valve, weighed it and its spring, measured its lift and calculated the time it would take to reach its seat, and found that it was very nearly that consumed by one stroke of the engine—.05 second. The engine was simply driving the air into the reservoir and drawing it out again. When we adapted our apparatus to the conditions we got the air pressure all right.

If in Mr. Berger's formula we take w as the weight of the valve in ounces, S the lift of the valve in inches or fraction thereof, and T the average tension of the spring in pounds, the formula will be approximately as follows:

$$t = .0178 \sqrt{\frac{w\ S}{T}}$$

t being in fractions of a second, of course.

### CYLINDER COOLING.

In regard to cylinder cooling, Mr. Berger has again, I think, opened a very fruitful field of inquiry. The subject of heat radiation seems to have been little studied in this connection.

In "A Practical Treatise on Heat," by Thomas Box, we find formulas of the form given by Mr. Berger and tables calculated from such formulas. The following are extracts from said tables:

Extract from Table 104.

RATIOS FOR RADIANT HEAT.

| Excess temperature of radiant over recipient. | Temperature of recipient. 68° Ratio. | 86° Ratio. |
|---|---|---|
| 18 | 1.165 | 1.254 |
| 36 | 1.206 | 4.299 |
| 54 | 1.251 | 1.348 |
| 72 | 1.302 | 1.403 |
| 90 | 1.360 | 1.463 |
| 108 | 1.416 | 1.525 |
| 126 | 1.48 | 1.59 |
| 144 | 1.54 | 1.65 |
| 162 | 1.60 | 1.73 |
| 180 | 1.68 | 1.81 |
| 198 | 1.75 | 1.89 |
| 216 | 1.83 | 1.97 |
| 234 | 1.90 | 2.06 |
| 252 | 2.00 | 2.15 |
| 270 | 2.09 | 2.22 |
| 288 | 2.20 | 2.37 |
| 306 | 2.31 | 2.49 |
| 324 | 2.42 | 2.62 |
| 342 | 2.54 | 2.73 |
| 360 | 2.66 | 2.86 |
| 378 | 2.79 | 3.00 |
| 396 | 2.93 | 3.40 |
| 414 | 3.07 | 3.31 |
| 432 | 3.23 | 3.76 |

The ratios given in the second and third columns are simply the factors by which the products of the factor (which Mr. Berger calls k) by the excess of temperature are to be multiplied to get the quantity of heat indicated—that is, calling the ratio R, we would have

$$Q = k\ t\ R$$

It does not seem to me, however, that the ordinary formulas for radiant heat should be used for surfaces which face each other, as the ribs shown, because the opposite surfaces will radiate to each other. I have before me notes of experiments made by me six years ago as to what effect different surfaces had upon the amount of heat given off by a series of pipes. The pipes were heated by running steam into them, and the amount of heat given off measured by weighing the water condensed. The following are the data recorded:

| Nature of surface. | Weight of water condensed per hour |
|---|---|
| Tarnished and dirty | 8.25 |
| Clean | 7.25 |
| Covered with resin | 11.625 |
| Covered with black varnish (shellac and lamp black) | 12.625 |
| Four or five coats black varnish | 14.667 |

"Ganot's Physics" says that the radiation will increase up to 16 coats of a good radiating varnish.

Table 105 of Box's treatise gives ratios similar to those of table 104 applicable to heat emitted by contact of air. The following is an abbreviation:

| Difference of temperature. | Ratio. |
|---|---|
| 18 | .94 |
| 36 | 1.11 |
| 54 | 1.23 |
| 90 | 1.372 |
| 126 | 1.486 |
| 162 | 1.575 |
| 198 | 1.65 |
| 234 | 1.72 |
| 270 | 1.774 |
| 306 | 1.827 |
| 342 | 1.874 |
| 378 | 1.92 |
| 414 | 1.96 |
| 468 | 2.017 |

### BACK EXPLOSIONS.

I noticed in your columns an interesting discussion some time ago as to the method of preventing the mixture from exploding back into the carbureter. I have not been able to prevent this with gauze without objectionably obstructing the inlet pipe. I found, however, that if I bored a couple of metal plates, perhaps half an inch thick, full of small holes and placed them opposite each other a little way apart, say ⅛ in. or 1-16 in., and placed two or three pieces of gauze between them, the back firing was prevented without very greatly obstructing the flow of the gases in the pipe.

E. J. STODDARD.

# OUR FOREIGN EXCHANGES.

## Road Locomotion.

By H. S. Hele-Shaw.*

### BALANCING.

The satisfactory balancing of the gas engine is a much more difficult problem than that of the steam engine. In the first place, owing to the explosions in the cylinder of the former, the piston receives a violent impulse even under the best conditions of mixture and compression, which is quite different from the behavior of steam; secondly, steam can be regulated by admitting only a small quantity at a reduced pressure every stroke, whereas the Otto cycle, which is practically universal, only allows the impulse to take place once in two revolutions. This necessarily introduces an irregularity in the motion, the effect of which cannot be appreciably modified on a motor car by a fly wheel, and accentuates any want of balance in the working parts. When the engine is in gear and the vehicle traveling at a fair speed these irregularities are absorbed by the mass of the vehicle, but at slow speeds or when the engine is disconnected want of balance makes itself felt. The original Daimler placed the angles of the two engines nearly at 180 degs., and thereby mechanically effected the balance of the reciprocating parts, although, of course, there was a turning couple, which was, however, not of great importance, owing to the two cylinders being placed quite close together. But, strange to say, as progress has been made, this mechanical balance has been entirely departed from, and the two cranks of the similar engines are placed side by side on account of the fact above mentioned of the Otto cycle being employed, and there is found to be less vibration and generally better results, since the cranks would in the original plan be separated by angles of 180 degs. and 540 degs, whereas, if placed side by side, they are only really separated by angles of 360 degs. when measured by the period at which the successive impulses occur. Fig. 1 shows the typical ways in which balancing is effected. On this figure is shown the original Daimler, in which the cranks are separated, and in which the pistons are always moving in opposite directions. The Prétot and Koch (Fig. 1) is arranged with a single cylinder, having an Otto cycle, in which two pistons are employed moving in opposite directions (as also do the levers), connecting rods which are attached to the crank. This is in some respects a very effective method of balancing, but the increase in the number of rods is, of course, a serious drawback to its general introduction. In this, of course, as the cranks must be separate, the twisting action on the couples is unavoidable. The "Gobron" method (Fig. 1) has been very frequently adopted by other inventors. This effects the same end as in the previous case without requiring a number of additional levers, and is probably one of the only single-cylinder methods of balancing which entirely avoids the action of a twisting couple, the only other one known to the author being that of Hyler-White, shown on Fig. 1, which, however, as will be seen from the drawing, obliges the use of spur gearing. The Henriod system (Fig. 1) really corresponds to the Daimler method; although it is not so compact it has a theoretical advantage which becomes obvious when the crank effort diagrams are drawn out, from the connecting rods operating at different sides of the crank shaft. The Lanchester No. 1 is also shown on Fig. 1. In order to understand the action of this it must be remembered that the two cranks are disconnected, the two fly wheels moving in opposite directions; of course, with only a single-cylinder engine, the piston is not balanced, but as there are two connecting rods which move outward and inward in opposite directions, these balance each other perfectly, and by the addition of another cycle a perfect balance of the system can be obtained.

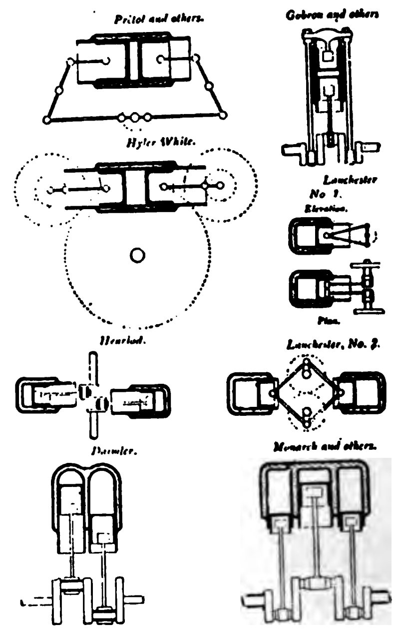



FIG. 1.

### EXTERNAL COMBUSTION (STEAM).

The external combustion motors for vehicles are, up to the present, entirely steam engines, and so much has been done in recent years in developing and improving steam engines upon a small scale that it is scarcely possible to have any absolutely new features in the engines themselves. Thus, although there are various special details which are of interest, it is not worth while to take up time in describing the varieties of the engines themselves that are employed. On the other hand, oil burners and boilers, as well as condensers, have in many cases been invented entirely with the object of their application in this direction, and must be, however briefly, touched upon. As before mentioned, the use of steam engines in this country has been to a great extent limited to heavy motor vehicles, and it is a point of great interest to compare how the more important makers have arranged the distribution of the boiler, motor, gearing, tanks, condensers, etc.

The principal systems of steam motor vehicles have been arranged for convenience of comparison upon one diagram (Fig. 2), and, further, for convenience, a uniform system of lettering has been adopted throughout. A glance at the diagrams will show the very varied methods in which makers have distributed the essential features of the heavy motor vehicle. It will be noticed at once that all the boilers except

* Extracts from a paper read before the Institution of Mechanical Engineers, April 26, 1900.

one are placed in the front and above the car. The exception is the Musker system; and this, owing to its having a horizontal boiler, and a special fan or draft for the burner, by which it is enabled to do without a funnel, is placed transversely under the middle of the car. The Musker system really differs from the others in the essential feature of employing a separate auxiliary engine, which supplies air and oil for the burner in proper proportions, and also water to the boiler. The fan, as will be seen from the diagram, takes the air through the condenser, in which it is partially warmed. It is obviously important to have the boiler and engine as near as possible to the main driving wheels, which are in every case the rear wheels, because, although when loaded the weight of the load is in most vehicles to a great extent distributed over the driving wheels, yet when running light, if the boiler and a fair proportion of the engine are carried upon the steering wheels, there may not be sufficient weight upon the driving wheels to provide tractive effort. A large platform area is provided by the Musker system, but at the same time it must be pointed out that when one of these vehicles is carrying its full load the weight is not so much concentrated over the driving wheels as in the other systems, which is a point decidedly in their favor.

The next important feature of difference between the systems is in the position of the engines. In the Thornycroft and Lifu systems (Fig. 2) the engines are placed horizontally in the middle of the wagon, and the main driving wheel is driven by means of toothed gearing. This is also the case in the Musker system. The Coulthard, Leyland, and Clarkson & Capel systems all have vertical engines which, by means of chain gearing operating through a countershaft, transmit the motion to the main driving wheel. In the Bayley system the engine is also vertical, but transmits the motion by means of a horizontal shaft placed longitudinally with the wagon, and driving a countershaft by means of bevelled gearing, which countershaft in turn drives the main driving wheel by a pinion and spur wheel. In the Simpson-Bodman system the distribution of parts for some reasons is the best of all, and the whole arrangement is extremely neat and ingenious. In this case there is a pair of small three-cylinder engines which work separately and independently the two main driving wheels. These engines are placed at the rear of the vehicle in a convenient and accessible position, and their weight, together with the weight of the gearing, tends to increase the tractive effort of the main driving wheels when the wagon is running light. By using separate engines, the necessity for a jack-in-the-box or differential gearing is avoided. Interchangeable spur wheels are used to transmit the motion from the engine to a countershaft, by means of which change of speed gear can be effected in a few minutes, and from them

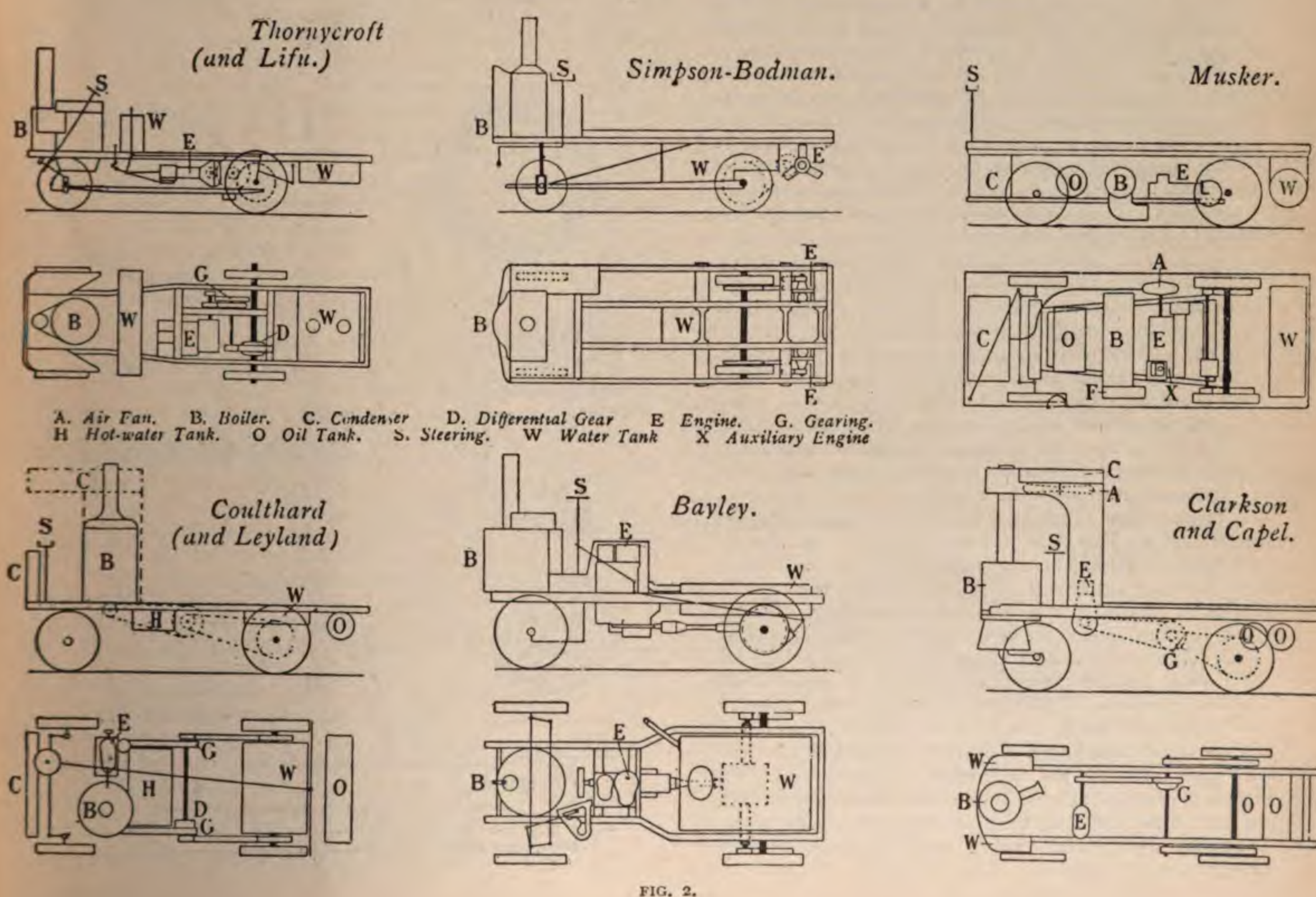



FIG. 2.

the power is transmitted to the main driving wheels by a powerful chain. The engines of Simpson-Bodman are very well balanced, and run so smoothly at several hundred revolutions a minute that a coin will stand upon its edge on the top of the cylinders.

Another important feature of difference between the various systems is to be found in the fact that the Musker, Leyland Coulthard, and Clarkson & Capel all use condensers, the location of which can be seen by an inspection of the various diagrams, whereas in the others the effect of superheating the steam is relied on in order to avoid the emission of visible vapor.

### BURNERS FOR LIQUID FUEL.

The number of burners for liquid fuel which have been invented in recent years is very great, and Fig. 3 represents the types of those in successful operation. An important distinction must be made between burners for light and heavy oil. For the latter, which are the burners chiefly illustrated, special means must be taken to heat in each case the petroleum in order to vaporize it, whereas, with a light spirit, vaporization, although necessarily effected on the same principle, is a far less difficult matter, and may be said not to involve the risk of carbonizing the products. It is well worth the application of considerable effort and ingenuity in devising means for the use of heavy oil, as it is relatively much cheaper and safer to use. For internal combustion engines, with one or two exceptions, light oils are invariably used on account of their cleanliness and ease of vaporization; while, on the other hand, for external combustion, in which petroleum is employed to heat the boiler, there are only one or two examples in which light spirit is employed. The Longuemare burner, which is shown in plan and elevation, is largely used in France, and consists of a row of coils through which the spirit is brought, from which it afterward passes down by a pipe B, through a needle valve which is regulated by a wheel C, which can be operated by the driver. The Lifu burner of the Liquid Fuel Co., late of East Cowes, has worked very successfully, and consists of a casting, D, in the tortuous passage of which the petroleum is made to circulate; it thus becomes thoroughly vaporized, since the casting is placed in the body of the flame which issues at E. F is an air cone which allows the proper proportion of air to mix with the vapor issuing from the needle valve, which is shown in section, and is self-regulating. A peculiar feature of the contrivance is an igniter, G, filled with fire brick, which is also maintained in a red-hot condition by the flame, so that, in the event of the flame being extinguished suddenly, it is immediately relighted from the white-hot fireclay, which acts as a temporary reservoir of heat.

In neither of the foregoing is any attempt made to regulate the air supply. This is an important matter in order to insure perfect combustion, and arrangements are made for doing so in both the Clarkson & Capel and Musker burners. In the former this is, in a sense, done automatically. The air can be regulated in quantity by altering the amount of opening of the diaphragm at LL. It mixes there thoroughly with the vapor which has been generated in the coil H, round which the flame circulates. This vapor enters the mixing chamber J through a small needle valve M, at the orifice K. The needle valve is opened and closed by a lever, P, which at the same time raises and lowers the larger valve N, so as to regulate the outflow of combined mixture of oil and air underneath at Q Q. the flame being baffled on the inside of a hollow nickel cone. The whole arrangement worked very satisfactorily in the Liverpool motor trials.

For the burner of Messrs. Musker the air is supplied by a fan which is driven by the same auxiliary engine which supplies both the water for the boiler and oil for the burner, the right proportion being thus automatically regulated. The air passes inward as shown through the passage J J, which is kept at a high temperature by means of cylindrical projecting ribs which form part of the solid ignition chamber K. The oil, which is admitted by drops at the point L, falling upon the heated iron surface is thus vaporized and immediately mixed with the heated air. The mixing is further insured by passing through a number of holes in a perforated block, M, and ignition takes place in the chamber K. The actual working of this burner is very striking, since the air being regulated in relation to the oil, the flame instead of, as in many cases, varying in quality according to the oil supply, and sometimes

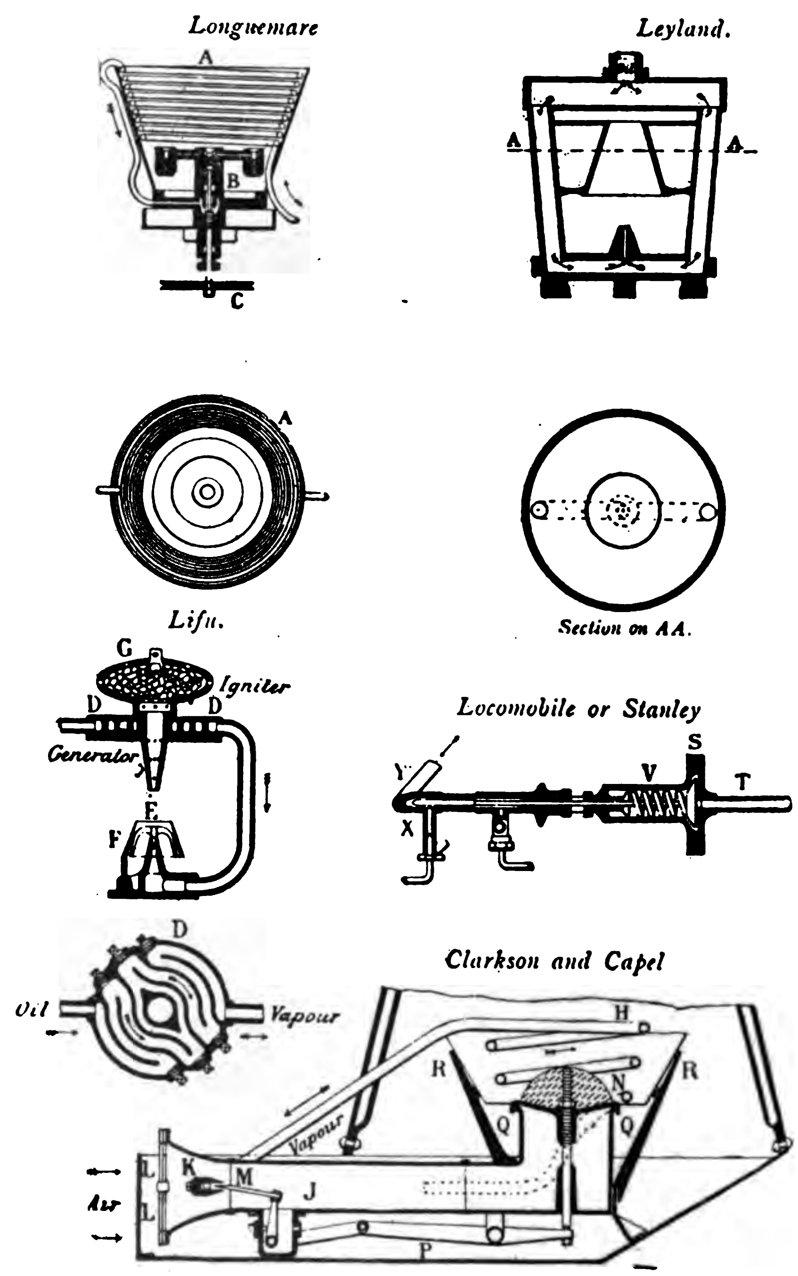



FIG. 3.

shooting forward in a long flame with a perceptible smell, is always, under the various conditions in which the author has examined it, of the same character and intensity. The conditions of ignition are always the same, although the actual size of the flame varies with the supply from the auxiliary engine. The Leyland burner is shown in section and plan.

The Locomobile or Stanley burner is given merely as an example of one for the use of light petroleum spirit or benzine. In this case the diaphragm at S has one side exposed to the pressure of steam from the boiler by means of a steam pipe, T. The spring V is thereby caused to regulate the needle valve at X, by which the spirit enters by the pipe Y and passes to the furnace under the boiler; thus the supply of spirit is regulated according to the pressure of steam in the boiler.

*(To be Continued.)*

## A Day in the 1,000-Mile Trial.

The progress of the 1,000-mile trial in Great Britain was marked by great public interest and even enthusiasm in the towns along the route. From the many notices in the local press, the following from the Derbyshire Advertiser and Journal, Derby, has been taken as one of the most representative:

The 70 or 80 automobiles taking part in the 1,000-mile trip organized by the Automobile Club, after a day's stay in Birmingham, left that city at 7 o'clock on Friday morning, and between 10 and 11 o'clock passed through Derby on their long journey north. They had previously made a temporary stoppage at Lichfield, where breakfast was partaken of, and whence at 9 o'clock the journey was recommenced. Thanks to favorable gradients, the run between Lichfield and Derby was a fast one, and when the first of the cars reached Littleover, where the timekeeper (Mr. Dryden) was stationed, it had a considerable time in hand. Here, according to the instructions contained in the official programme, speed was slackened, and the motors passed through Derby by way of Babington Lane, St. Peter's St., the Market Place, Iron Gate and the Duffield Road. It being market day, crowds of spectators lined the route through the town, and to them the event brought home the fact that in two ways the motor car of today—even though it be the latest pattern—leaves much to be desired. In the first place a smell of petrol pervaded the whole atmosphere in the vicinity of the line of passage, conveying to one the impression that motor men who enjoy themselves must be destitute of olfactory nerves; and again, though they had been only an hour or two on the road, most of the travelers appeared as dust-begrimed as if they had completed a long journey. Hats that had once been black were now an ashy gray; but the faces of the passengers—that is to say, such portions of them as were visible between the huge dust-defying goggles almost universally worn, and the high upturned collars of mackintoshes and oilskins—wore a grimy cheeriness of expression which led one to believe that, with all its defects, motoring has still some charm. It was shortly after 10 that the first batch of cars—they seemed to be gregariously inclined—arrived from Burton, whence the journey had been accomplished under half an hour. These were, of course, the lighter and speedier automobiles, the heavier patterns, owing doubtless to greater difficulty in the negotiation of the bills, having dropped somewhat behind. Each vehicle bore a number; those capable of accommodating it oftener than not carried the driver's and passenger's baggage; and in most cases where pneumatic tires were being used spare cases and tubes were taken also, for it would be a wonderful tire that could make a journey of 1,000 miles over roads (rough and smooth) without being liable to injury. Here and there a cyclist passed along in the wake of a car, travel-stained in proportion to the distance he had come, and it was to one of these that the only accident of the morning occurred. Close behind his pacemaker, he was pedaling along briskly in the Market Place, when the motorman pulled up sharp to do a little snap shooting, with the result that the cyclist ran into the back of the car and came to grief. Luckily, neither he nor his machine sustained any damage, and the journey was at once resumed. A slight delay was also caused at the corner of St. James's St. by the breaking of the shafts of a heavily laden wagon, but to get the road clear again was only the work of a minute or two, and no serious interruption of the traffic took place. Toward the tail of the procession came the baggage car, piled up with the portmanteaux and bags belonging to the travelers. What those in the leading vehicles would have done on arrival in the evening at the general rendezvous had this car broken down on the way is hard to say; but motormen are not influenced by such trifling risks as these, and they took their chance. Several ladies were hardy enough to undertake the journey, and clad as to be impervious to all weathers, right well did they seem to be enjoying it. Among the private cars accompanying the party was Mr. Alfred Harmsworth's Panhard, while that driven by Mr. Remington, of Nottingham, and one belonging to Messrs. Clarke & Co., Irongate, Derby, joined in at Derby and accompanied the club as far as Buxton. At Duffield, Belper, Ambergate and each succeeding place along the route the populace turned out in large numbers to witness the unwonted sight, and in many instances the children in the schools were given a holiday, that they too might see the horseless vehicles pass. Not a few of the cars reached Matlock some minutes before the stipulated time of arrival, and the picturesque resort was made the halting place for luncheon. A great number of people had journeyed to the town to witness the sight, and the various cars were closely scrutinized, though criticism was largely disarmed in face of the splendid work which the vehicles had already accomplished. Leaving Matlock soon after 1 o'clock, the automobilists were favored with the first gleams of the sun's rays, and thenceforward the journey was intensely enjoyable. Through the rugged grandeur of the Peak sped motor cars of all designs and sizes, and everywhere their appearance was a source of unending curiosity. Descendants of "the rude forefathers of the hamlet" gazed in open-eyed astonishment upon the horseless carriages, and their brethren in the larger communities were stirred in no less degree. Scores of cyclists had ridden scores of miles to swell the ranks of spectators, and in innumerable instances the friendly aid of the motor cars as pacemakers was eagerly sought. In Bakewell main street one cyclist all but paid a severe penalty for his persistent devotion. Two tiny bantams, with characteristic assurance, were airing themselves in the middle of the thoroughfare utterly regardless of the approach of a speedy car, and ere they had time to escape they were overtaken. Fortunately for the chicks, the car passed them unharmed, but the wheeler in the rear only just missed the pair of them by a hair's breadth. At the foot of Taddington Hill—the scene of the terrible cycling fatality at Eastertide—the automobilists were called to a halt to prepare for the hill-climbing competition. Taddington Hill, from the spot where the

competition commenced to the summit, is 4,446 yds. long, and in that distance it rises between 600 ft. and 700 ft. in gradients varying from 1 in 12 3-7 to 1 in 200. There were 115 yds. of the steepest piece, and other portions showed gradients of 1 in 15 and 1 in 16. It was a severe test for the vehicles, but for the most part they mounted splendidly, the first to reach Buxton being a small but speedy tricycle manufactured by the Century Engineering and Motor Co., Ltd., Altrincham. Here half an hour was allowed the competitors, and then followed another stiff climb up to the famous Cat and Fiddle, along a road skirted on either side by dreary moorland. There were many exhilarating moments along the long, steep and winding decline to Macclesfield, a drop of 1,200 ft. in 6 miles. The committee had selected the longer route to Manchester, but sudden descents and awkward corners were safely negotiated, and the vehicles passed through the narrow, dirty streets of the Cheshire town under the gaze of an admiring multitude. Except for a few charming villa residences here and there, the road from Macclesfield, through Alderley, Wilmslow, Cheadle, Didsbury and Chorlton, was dull and uninteresting, compared with what had gone before, but there was still the same outburst of public curiosity and enthusiasm all along the line, till finally the Botanical Gardens, at Manchester, were reached by the majority of the vehicles just before 6 o'clock. This was the end of the day's journey of 103¾ miles, and on Saturday an exhibition of the cars was held, the opening ceremony being performed by the Lord Mayor.

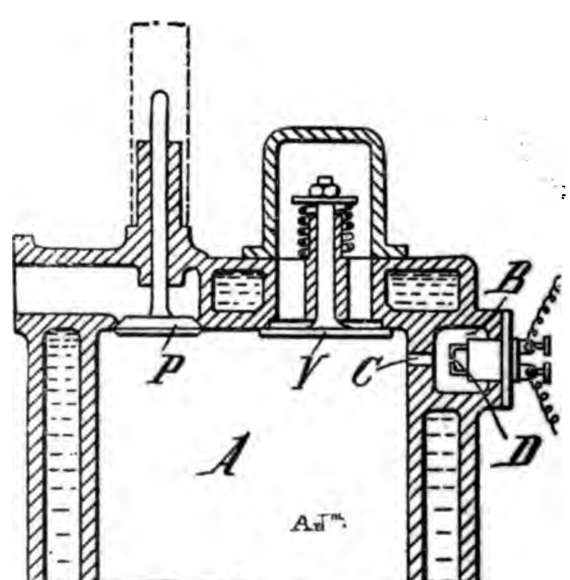
## The Automobile Club's 1,000-Mile Trial.

The official record of the hill climbing on Birkhill was as follows:

| | | Miles per hour. | Number of persons on car. |
|---|---|---|---|
| A17 | Hon. C. S. Rolls' 12-h.p. Panhard | 16.0 | Two |
| 3 | 3½-h.p. Ariel quadricycle | 13.3 | One |
| 4 | Ariel tricycle and Whippet trailer | 12.6 | Two (both had to dismount) |
| 12 | Motor Mfg. Co.'s tricycle | 12.6 | |
| A28 | E. M. Iliffe's Enfield quadricycle | 12.0 | One |
| A10 | E. Kennard's 8-h.p. Napier | 11.5 | Three |
| A22 | J. A. Holder's 12-h.p. Daimler | 10.9 | Four |
| 26 | 8-h.p. Peugeot car | 10.9 | Two |
| 39 | Century tandem tricycle | 10.9 | Two (both had to dismount) |
| 5 | Locomobile steam car | 10.9 | Two |
| 14 | De Dion voiturette | 10.9 | Two |
| A11 | Hon. J. S. Montagu's 12-h.p. Daimler | 10.4 | Two |
| A29 | M. Mayhew's 7-h.p. Peugeot | 10.0 | Two |
| 31 | M.C.C. Triumph | 9.6 | Two |
| 23 | Brown Whitney steam car | 8.9 | Three (one alighted for restarting) |
| A27 | J. K. Hargreaves' 12-h.p. Daimler | 8.9 | Three |
| A 3 | T. B. Browne's 6-h.p. Panhard | 8.6 | Three |
| 34 | Decauville car | 8.6 | Two (one dismounted) |
| 40 | Wolseley voiturette | 8.6 | Two |
| A31 | Mr. Exe's 6-h.p. Parisian Daimler | 8.2 | Three |
| 37 | 6-h.p. Daimler Parisian | 8.0 | Two |
| 51 | Star voiturette | 8.0 | Two |
| 27 | New Orleans car | 7.7 | Two (one alighted) |
| 22 | Lanchester car | 7.7 | Two |
| 46 | Richard car | 7.5 | Four (one alighted) |
| A24 | R. E. Phillips' Mors Duc | 7.5 | Two |
| 16 | Gladiator voiturette | 7.5 | Two (both alighted) |
| A30 | J. D. Siddeley's 6-h.p. Parisian Daimler | 7.0 | Two |
| 35 | 6-h.p. Daimler | 6.8 | Three (one alighted) |
| A16 | A. J. Wilson's Ariel tricycle | 6.8 | Driver pushing |
| A 7 | A. Harmsworth's 6-h.p. Parisian Daimler | 6.6 | Two (one alighted) |
| 2 | Benz Ideal (1900 pattern) | 6.6 | Two (one alighted) |
| 36 | 6-h.p. Daimler | 6.6 | Three |
| 8 | Motor Mfg. Co.'s 6-h.p. phaeton | 6.5 | Three |
| 9 | Motor Mfg. Co.'s 6-h.p. Iveagh phaeton | 6.3 | Three (one alighted) |
| 49 | Marshall car | 6.3 | Two |
| 1 | Hewetson's Benz Ideal | 6.0 | Two (both alighted) |
| A 2 | F. H. Butler's 6-h.p. Panhard. | 5.7 | Three |
| 47 | Richard car | 5.0 | Three (all alighted) |
| A21 | E. Pitman's 6-h.p. Daimler | 4.8 | Two |
| A23 | C. Cordingley's 6¼-h.p. Motor Mfg. Co.'s phaeton | 4.6 | Two (both alighted) |
| A26 | C. K. Gregson's 6-h.p. Daimler | 4.1 | Three (one walking) |
| 44 | International victoria | 4.1 | Two |

## The New Daimler Ignition Apparatus.

Perhaps one of the last improvements that Herr Daimler made in his well-known motor was the following device for insuring the instantaneous ignition of the charge in the combustion chamber. The present methods of effecting electrical ignition are not altogether satisfactory, as under certain conditions a carbon deposit is formed on the poles of the igniter,



and which constitutes a partial short circuit, with, of course, either a small and feeble spark or none at all. Herr Daimler has sought to overcome this defect by passing the electrodes or poles of the ignition device in a separate chamber outside the combustion chamber. The method adopted will be clearly seen by referring to the accompanying drawing, which represents a vertical section of a motor cylinder.

A is the main combustion chamber, having an inlet valve, V, and an outlet valve, P, and connected by means of a small passage, C, to an auxiliary chamber, B, in which the ignition takes place. Within this chamber B is arranged the electric ignition apparatus D, operated in the usual way.

Supposing the chamber A be filled with mixture, a small quantity of this will pass through the passage C and enter the ignition chamber B.

When the ignition of this compressed mixture within the chamber B takes place the ignited gas is expelled and re-enters the combustion chamber with great force, thereby igniting instantaneously the whole gas contained within it.—The Automotor Journal.

[An arrangement of this kind is only necessary where the valves open directly into the cylinder, as shown, as the lubricating oil will very quickly coat the porcelain insulators, both in vertical and horizontal motors, but where the valves are in a passage to one side of the cylinder, the ignition plug should be placed in this passage and no trouble will be experienced.—Ed.]

## A Remarkable Feat.

Grahame White, driving a Parisian Daimler, had an adventure on the run from Edinburgh to Newcastle. It appears that when 17 miles north of Alnwick, on a quiet bit of road, he yielded to the request of one of his passengers to be allowed to try a hand at driving. The result was that the said novice turned the car into the ditch, and the effect of this little contretemps was to break the bracket of the steering gear. There were still 52 miles of road to cover, but Mr. White was in no wise daunted, and conceived the idea—which he carried to a successful issue—of steering the car with his foot. Standing on the off step with his left foot, he kept his right on the hub of the off front wheel, and, by pressure only, he guided the car the whole way to Newcastle. What is still more wonderful, he averaged 10 miles an hour for the 52 miles, and as the road included several steep hills, two or three "controls" and a compulsory stop of a quarter of an hour for tea at Morpeth, he must have traveled at a good speed at several stages of the journey.—The Motor Car Journal.

## A Novelty in Tires.

A German scientist has patented a puncture-proof tire filling. If successful it will prove a boon to bicycle riders, as well as to owners of rubber tired vehicles of all kinds, and air saddles and cushions. The filling is a jelly made of glue. Glycerine is added to prevent hardening, and an antiseptic preparation that keeps it from fermenting. The mixture is first heated until it liquefies, and is then beaten to a stiff foam. While in this frothy condition it is introduced into the tire or saddle, and allowed to cool and partly solidify. The result is a light, spongy material, of cellular formation, exceedingly light in weight, and proof against tacks, nails, glass and all puncturing objects. The formula for making it is not expensive, and the results so satisfactory that it will become generally used—so it is said.

## MINOR MENTION.

J. Cæsar Koch, of Koch Frères, Paris, the well-known oil engine expert, is now visiting this country.

The Committee of Public Safety in Rochester is considering the subject of motor vehicle regulation.

Will "One of the Cranks," whose letter was published in our issue of May 9, please send his name to this office?

The agitation in favor of throwing open the whole of Fairmount Park to motor carriages is being renewed.

Illinois Electric Vehicle stock, whose par is $5 a share, paid, has lately been quoted at 1¼ bid and 1¾ asked. It has sold as high as 8.

Buffalo is to have a gasoline mail wagon before long. It is to be built by the Conrad Motor Vehicle Co., of Black Rock, and will carry from four to six bags.

The Explosive Vapor Motor Co. has filed articles of incorporation in New Jersey. The capital stock is fixed at $300,000, of which $1,000 is paid in.

The New York Automobile Co., Westfield, N. J., has been incorporated. Capital, $200,000. Incorporators, Chas. G. Bliss, Frank R. Slade, Edward Rode, M. J. Hester and Henry B. Shute.

The American Express Co. has determined to make a trial of the electric vehicle for delivery purposes, and with this object a Woods delivery wagon has been sent to the Milwaukee, Wis., office.

The Richmond Electric Co., Manchester, Va., has been chartered to manufacture generators, automobiles and all kinds of electrical machinery. The capital stock is to be not less than $50,000 nor more than $100,000.

J. F. Palmer, of Chicago, and H. M. Strowbridge, of Tarrytown, N. Y., have been making a trip from the latter place to Chicago in a "Mobile" steam carriage. No attempt at a speed record has been made.

The Slaymaker-Barry Co., South Connellsville, Pa., is enlarging its plant for the manufacture of motor vehicles. They have received many orders, among them being an order for 30 for the War Department.

An ingenious Canadian has fitted a motor to a sleigh for ice sleighing. The motor operates a spiked wheel set between the rear runners, the front runners being used for steering. The rider sits and drives as in a motor quadricycle.

The Automobile Supply Co., St. Louis, Mo., have sent us a circular descriptive of their product. They manufacture and supply to the trade numerous varieties of wheels, hubs, bearings, transmission and running gears, and frames and running gears complete ready for the motor and the body.

The Century Motor Vehicle Co., Syracuse, N. Y., has sent us their catalogue illustrating the Century electric, steam and gasoline vehicles for pleasure and business purposes. Their electric Stanhope was illustrated in The Horseless Age of April 25, and a brief description was there given of the leading features of these vehicles.

We have received the catalogue of the Waverley Electric Vehicles. It is beautifully gotten up on coated paper, with dark green limp cover, and it illustrates some very stylish types of vehicles. The merits and limitations of electric vehicles are well set forth, and a special feature is the offer of a five-year contract to keep the battery in order.

An ordinance has been proposed in Milwaukee, Wis., for regulating motor vehicles. It provides that each machine shall carry lights in the evening of colors so that a pedestrian can tell which way the machine is going. It also provides that each owner of an automobile shall take out a license, and the speed must not be over 6 miles an hour in the city.

Mr. George Isham Scott, chairman pro tem. for the committee on runs and tours of the Automobile Club, announces a new route for the trip to Philadelphia from this city on June 2. The start will be made from the Staten Island Ferry and travel will then continue to Tottenville and across the ferry to Perth Amboy; thence through Metuchen, New Brunswick, Princeton and Camden.

In Pittsburg horse vehicles of all kinds are assessed according to the number of horses required to draw them. A one-horse vehicle requires a $6.50 license; a two-horse vehicle $10,50, and a four-horse vehicle $12.50. The automobiles are a distinct innovation in Pittsburg this year, and in the absence of any definite instructions on the subject the clerks decided to put a one-seated automobile in the one-horse class and a two-seated vehicle in the two-horse class.

The Noye Mfg. Co. have been running overtime to fill orders for carriage motors, as well as their marine motor. They have entered the foreign market and have commenced to fill orders for other countries. A duplicate order from the McCormick Harvesting Machine Co. has just been filled with a special motor, highly nickel-plated, which will drive some of their harvesting machinery in the Paris Exposition. With its increased facilities this company expects soon to have a stock of motors on hand that will be equal to the great demand for them.

## By Motor to the Klondike.

E. Janne de Lamare, a French mining expert, and R. Merville, who went to the Klondike region in an automobile, sailed for home May 24 on the French steamship L'Aquitaine. It took them more than four months to make the trip from Fort Bennett to Fifty-Mile River, Alaska.

"The trip on the automobile was very interesting," Mr. Lamare said. "There were many rough places where we could not run the machine, but most of the way we were able to do so. We were followed by a sled drawn by oxen, on which were the supplies and the gasoline for the automobile. We would go ahead in the 'auto' as far as we could and then wait for the sled and replenish our supply of gasoline. Once, while crossing an unusually rough pass, we broke one of the supply tubes of the machine, and were forced to take a tow from the sled. Fortunately, however, there was a blacksmith shop in the Chilcoot Pass. At another time we were so far ahead of the sled that we were without food for more than fifteen hours.

"Our longest day's run was 110 miles. That was an exception, though. Most of the runs fell far short of that figure. We had with us an arrangement of skates to fasten to the machine in crossing ice. We were not obliged to use them, as we found the automobile could run well on the ice where the snow was not too thick. The ordinary rubber tires held excellently, and kept the 'auto' from slipping.

"We visited Tagish Lake, Marsh Lake, Aplin Lake and Taku. Some of the people who had never seen an automobile looked on the machine with awe and wonder. At Fifty-Mile River we turned back because we found the river open. Our large automobile we left behind us, but a light electric machine we had with us is now on board this ship."—N. Y. Commercial Advertiser.

## METROPOLITAN ITEMS.

The Automobile Storage and Repair Co. has added an extra repair room at its depot in 57 W. 66th St. A new depot will be opened on the East Side before fall.

E. Schwartzkopf has recently brought to this country his forecarriage vehicle, made under the patents of the Kühlstein Wagenbau patents. It is being taken care of at the Automobile Storage and Repair Co.'s depot at 57 W. 66th St., this city.

The West Side Association of New York City has secured a ruling to the effect that motor carriages come under the speed regulations governing bicycles. A test case made recently in the case of John Brant, employed by the Locomobile Co. of America, resulted in the above decision.

J. H. Williams & Co. have sent us their May, 1900, catalogue and price list of drop forgings. A large variety of wrenches, in all sizes and degrees of finish, and many specialties such as lathe dogs, keys, tool posts, cranks and handles, crane hooks, chain pipe wrenches, etc. Gas engine valves and crank shafts, and parts for motor vehicles are also noticeable, and special forging work of any description is undertaken on order.

The users of De Dion and other air-cooled motors in France consider the grade of lubricating oil used in them a most important factor in their successful performance. The heavy gas engine oils are found to burn up and leave a residue which clogs the piston, and the best satisfaction is derived from the use of a somewhat light oil of moderate viscosity and yet of high fire test, which, when it has done its work as a lubricator, burns up completely and leaves no residue behind. W. R. Winn, 143 Maiden Lane, New York, handles an American oil which is claimed to fulfill the above conditions, and whose characteristics, as shown by test, are said to be as follows: Sp. gravity, 20 degs. Baumé; fire test, 600 degs. Fahr.; cold test, 20 degs.; viscosity, 400.

## An Automobile Highway.

John D. Quackenbos, formerly a professor in Columbia University; John Hay, Secretary of State; Gov. Rollins, of New Hampshire, and N. J. Bachelder, Secretary of the New Hampshire Board of Agriculture, are reported to be interested in a project for a 500-mile road for the exclusive use of motor and pleasure vehicles through the scenic sections of New Hampshire. The route proposed is thus described:

The road is to start from Boston and go up through the historic towns of Lexington and Concord. From Concord the road will run to Dublin, N. H., and thence to Keene. From Keene it will cross to Lake Sunapee. It will follow the east shore of the lake, with a branch to the Austin Corbin deer park. Thence it will run through the town of Springfield to Hanover. The route will then be up the Connecticut Valley to the Connecticut lakes; thence through the White Mountains to Plymouth, N. H., and down to the Maine coast by way of Lake Winnipiseogee, and back to Boston along the sea coast. The distance will be 500 miles, and the cost of building, exclusive of the land, will be $3,000,000. President Chamberlain, of the Automobile Association of America, is deeply interested, and has asked for connections from New York and Philadelphia. These connections will go through the Berkshires and join the main road at Hanover, either by way of Bennington and Brattleboro or by the Rutland Pass.

When asked as to the length of time which would be required for the construction of the road, Prof. Quackenbos said he expected to see it completed within five years. The road, he said, would be of macadam. Whether the roadbed would be entirely new or partly composed of old roadway worked over, he said, had not been settled.

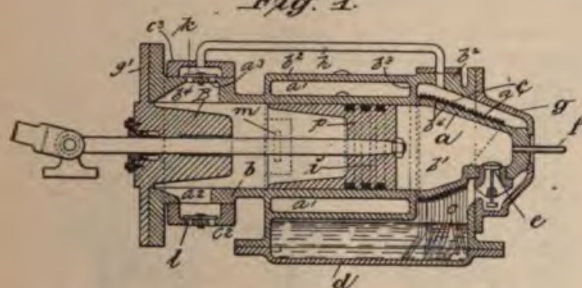
# MOTOR VEHICLE PATENTS of the world

## UNITED STATES PATENTS.

No. 648,914—Vaporizer for Petroleum Motor.—Henrik August Bertheau, Stockholm, Sweden. May 8, 1900. Application filed July 20, 1898.

The general form of the cylinder and attached parts will be seen from the drawing. The cylinder head is unjacketed, and the kerosene is drawn up by wicking, c, from the reservoir d into contact with the head, where it is vaporized by the heat of the latter: The two-stroke cycle is used, air being drawn in at l and pumped by the piston through k and into the pipe h to the vaporizing chamber surrounding the head. The exhaust valve is at m, and the mixture enters the cylinder through the valve e.

Fig. 1.



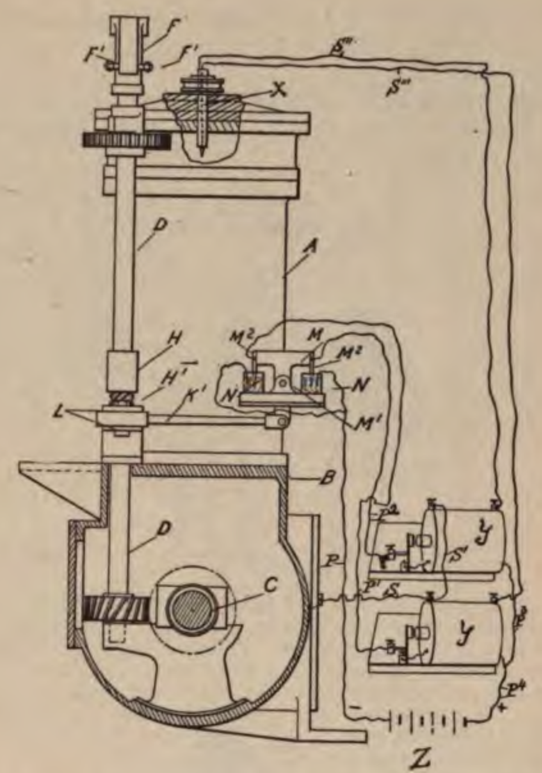
Evidently a motor on this plan is suited only to work where the load is uniform, since vapor is being constantly evolved from the saturated wicking, whether used or not; and this fact is pointed out in the specifications.

Five claims.

No. 649,057—Governor for Explosive Engines.—Chas. M. Johnson, New York, N. Y. May 8, 1900. Application filed Sept 9, 1898.

In the motor proposed the jump spark ignition is used, and the primary circuit is momentarily closed in each cycle by the dipping of contact points $M^2$ into mercury cups. Governing is effected by retarding the time of ignition.

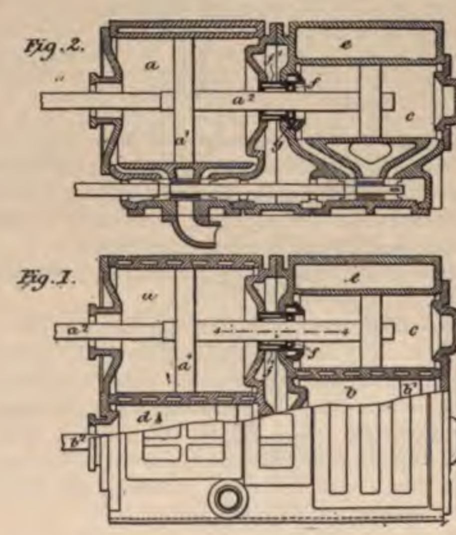
The sleeve D, rotated by gearing from the crank shaft C, carries a fly ball governor of the ordinary type at its upper end, which acts on a rod inside the tube D. This rod, by means of transverse pins projecting through vertical slots in D, carries an outside sleeve, H, at its lower end, which terminates in a steep-pitch screw-threaded extension, H′. This extension H′ passes through an eccentric, K, guided between two horizontal plates, L, and it is evident that when by the action of the governor the sleeve H H′ is raised or lowered the eccentric will thereby be slightly rotated in one or the other direction, relatively to the sleeve D. The eccentric arm K′ rocks a T-piece, M, to which the contact points $M^2$ are fixed, and the latter therefore dip alternately into the mercury cups N, at times regulated by the lead of the eccentric.



A film of oil is used on the surface of the mercury to prevent oxidation of the latter and the production of undesirably large sparks on breaking contact. The induction coils Y and plugs X are of the usual construction.

Six claims.

No. 649,109—Locomotive or Traction Engine.—Wm. R. Renshaw, London, Eng. May 8, 1900. Application filed Feb. 15, 1900.

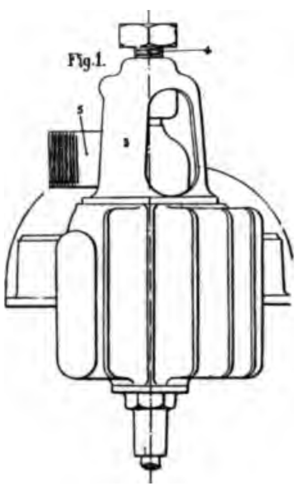


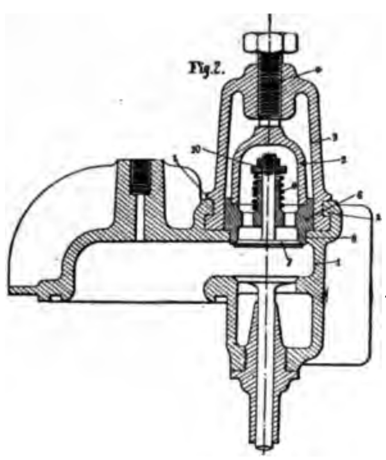
This invention consists in the particular arrangement of two pairs of high and low pressure cylinders shown in the drawing, each high-pressure cylinder being placed beside one low-pressure cylinder and tandem to another. Suitable valves distribute the steam, and provision is made for screwing up the

interior stuffing boxes by a worm passing through a stuffing box.

Three claims.

No. 649,277—Valve for Explosion Motors.—A. de Dion and G. Bouton, Puteaux, France. May 8, 1900. Application filed Aug. 3, 1898.





The bell 3 is attached to the valve box 1 by a sort of bayonet joint at 2, which releases the three lower lips when the bell is turned through one-sixth of a revolution. The suction tube or cap 5 and the valve seat ring 6 can then be lifted directly off, after unscrewing the pipe connection to 5. When the parts are in place the set screw 4 makes all parts rigid.

Two claims.

No. 649,301—Engine.—G. H. Hardie and N. Thompson, Vancouver, Can. May 8, 1900. Application filed Sept. 8, 1899.

A three-cylinder steam engine, with the cylinders spaced radially about a common crank shaft, and the three single-acting on one crank pin. The engine will reverse, but has a fixed cut-off. Splash lubrication is supposed to be used, the arrangement shown virtually water jacketing the two lower cylinders in a bath of 212 deg. temperature.

Six claims.

No. 649,441—Sparking Igniter for Explosive Engines.—Chas. E. Duryea, Peoria, Ill., assignor to the Duryea Mfg. Co., of same place. May 15, 1900. Application filed Aug. 25, 1896.

Four claims.

No. 649,594—Traction Engine.—F. W. Bohn, Independence, Wis., assignor of one-half to Math. Elstad, same place. May 15, 1900. Application filed Nov. 21, 1899.

Fifteen claims.

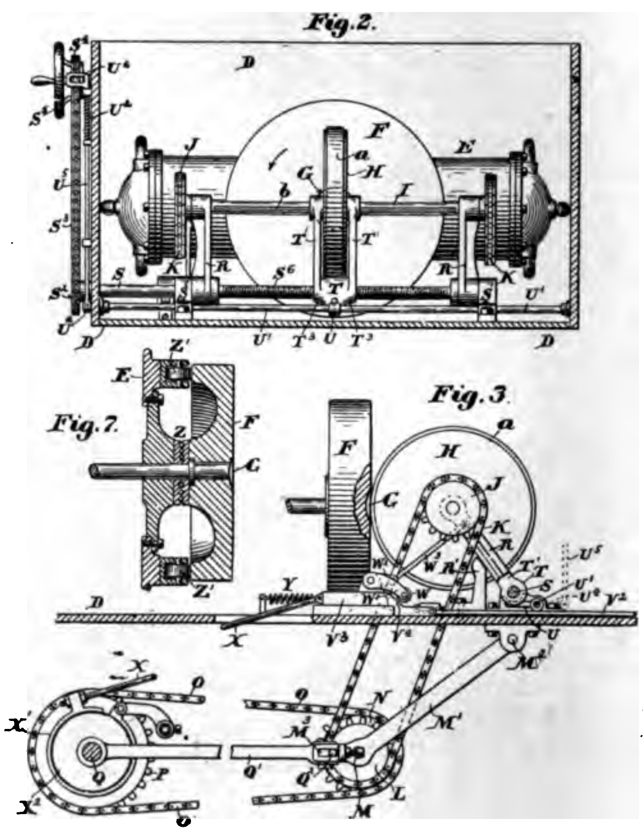
No. 649,667—Motor Carriage.—Wm. B. Mason, Boston, Mass., May 15, 1900. Application filed Nov. 11, 1899.

In the drawing the engine A, instead of being fixed rigidly to a cross bar in the body of the carriage, whereby the tension of the chain undergoes variation with every relative motion between the body and the frame, is hinged at 8 by suitable ears, and a hinge bolt, as shown; and an adjustable distance rod, H, is added to keep the chain tension constant. The necessary flexible connection in the steam pipe is provided as shown in Fig. 2, the two unions 11, 12 being free to turn slightly, as required.

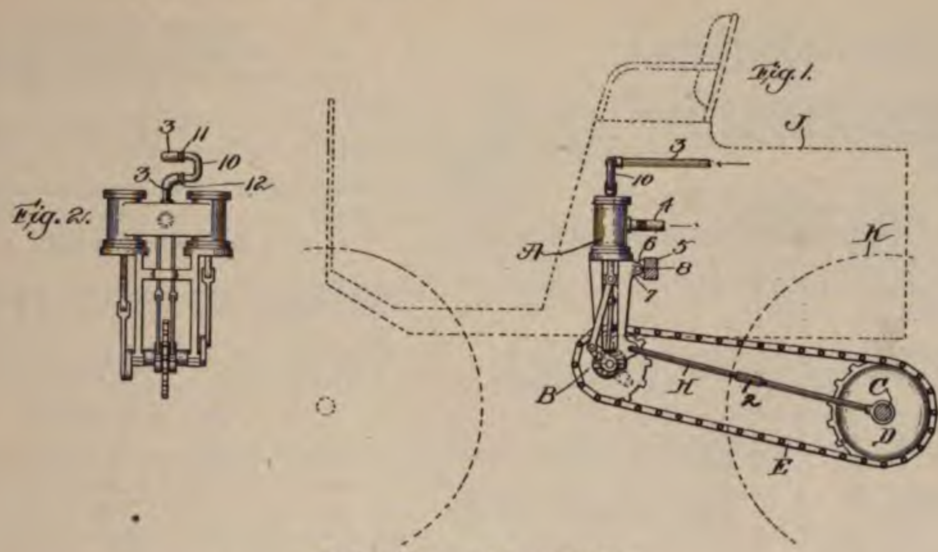
Three claims.

No. 649,689—Motor Carriage.—R. M. Gay, Cambridge, Mass., assignor of one-half to Wm. H. Ricker, same place. May 15, 1900. Application filed Jan. 31, 1900.

Fig. 2 shows a section of the body just back of the seat and looking to the rear. The motor is shown in outline at E, and F is a combined fly wheel and friction disk, against which the friction wheel H bears. In Fig. 3 F is shown in side view. The sprocket wheels K transmit the power to the wheels L on the shaft M, whence chain O, kept tight by distance bar O′, conveys it to the differential on the rear axle



Q. The wheel H is splined on the shaft I and is shifted for change of speed by the screw $S^6$, working in a nut, T, and rotated by sprocket chain and hand wheel $S^5$. The arms R are pivoted at S, and the intention is that as the pull on the chain becomes greater with greater load, the wheel H shall




No. 649,667. MOTOR CARRIAGE.

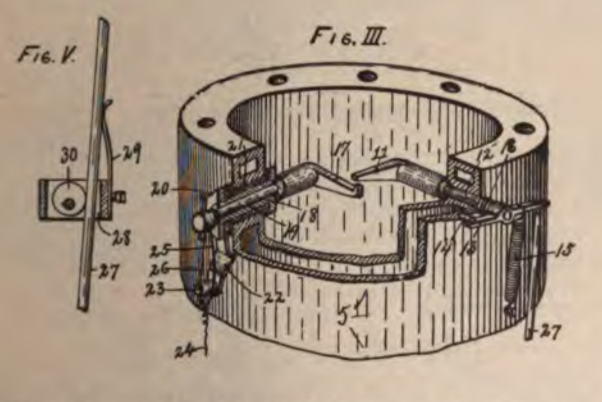
thereby be pulled so as to press correspondingly more tightly against F. To disconnect the power quickly, a cam-shaped slide, $V^3$, is provided, pulled by a treadle acting on a rod, $V^2$, and this pushes up the short lever W′, which is toggle-jointed to the arms R and raises them till H is out of contact with F. The same movement pulls on the brake rod X and applies the brake. On releasing the treadle, W′ is retracted by the spring Y. A ball collar, Z, and rollers, Z′, take the axial thrust on F from the crank shaft.

Nine claims.

No. 649,775—Tire for Vehicle Wheels.—John M. Sweet, Batavia, N. Y., assignor to Frank Richardson, trustee, same place. May 15, 1900. Application filed March 21, 1900.

No. 649,778—Electrical Igniter for Gas Engines.—D. M. Tuttle, Canastota, N. Y. May 15, 1900. Application filed Feb. 20, 1899.

In Fig. III. the push rod 27, operating the right-hand electrode, is actuated by an eccentric, and runs through a guide, Fig. V., a little lower down on the engine, so that its upper end describes an approximately elliptical path, pushing on the T-arm 13 and then moving to the right and releasing the arm. The operation of the mechanism is thus described in the specifications:




"At each rotation of the shaft, operating rod 27 is thrown upwardly, engaging with spring end of terminal arm 13, forcing it up against the action of spring 15 and depressing the terminal 11, which engages with and depresses terminal 17 against the force of spring 25. After this downward movement of the terminals has progressed to a certain point the lower end of operating rod is thrown to left by eccentric and the upper end to the right, the guide acting as a fulcrum whereby the rod is thrown out of engagement with terminal arm and clear therefrom. The springs 25 and 15 come suddenly into play, forcing the terminals in the reverse direction from that in which they had been traveling. This return movement of terminal 17 is stopped by engagement of small rod 26 with binding post 23, while that of terminal 11 continues, making a quick break and drawing out a spark until it is arrested by engagement of arm 13 with stop 14."

Regulation of the moment of ignition is effected by adjusting the eccentric cam 30, Fig. V.

Three claims.

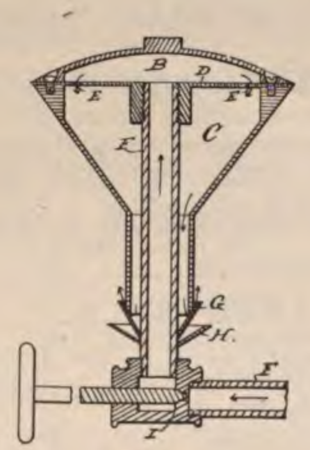
No. 649,802—Ball Bearing.—Wm. J. Brewer, London, England. May 15, 1900. Application filed Sept. 21, 1899.

Six claims.

No. 649,881—Hydrocarbon Burner.—C. R. Sutton, Carpenteria, Cal., assignor of one-half to Joel R. Fithian, Santa Barbara, Cal. May 15, 1900. Application filed Nov. 23, 1899.

In the drawing, H is a pan to be filled with liquid fuel to pre-heat the vaporizer before starting. The direction of fuel and vapor flow is shown by the arrows, and the vaporizer is threaded on the upper end of the tube F so that it can be screwed up or down to regulate the burner aperture at G.

Two claims.



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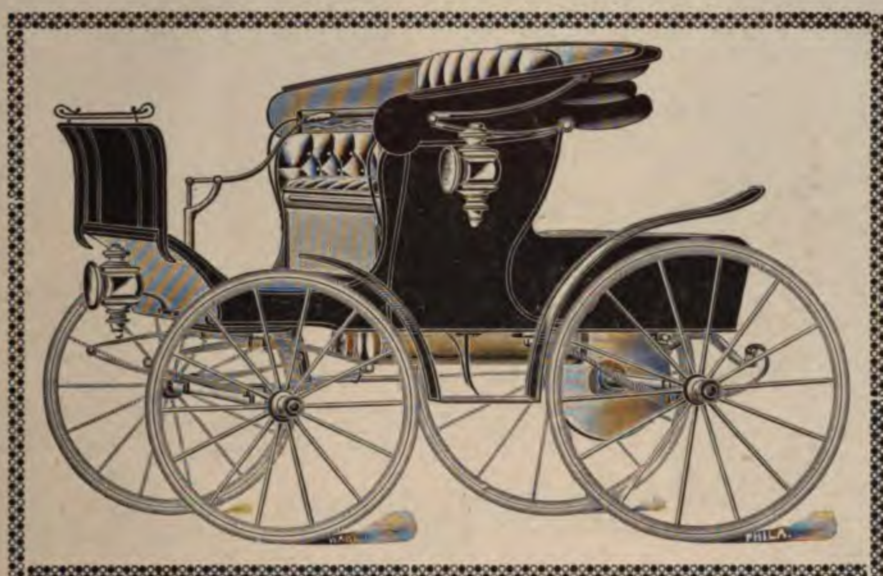

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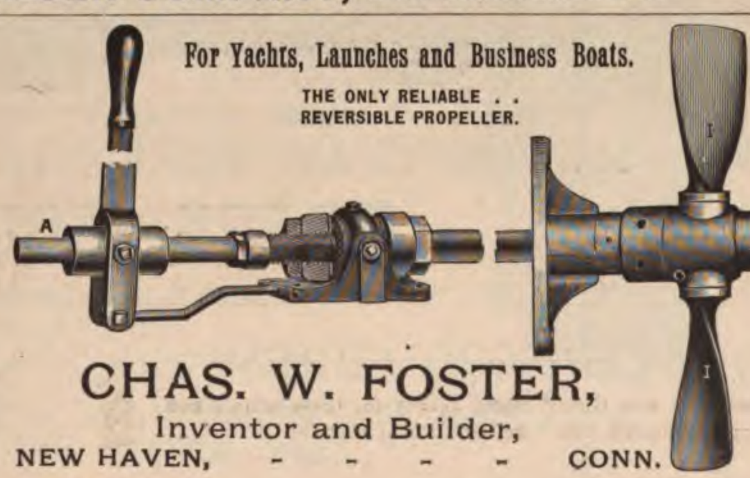

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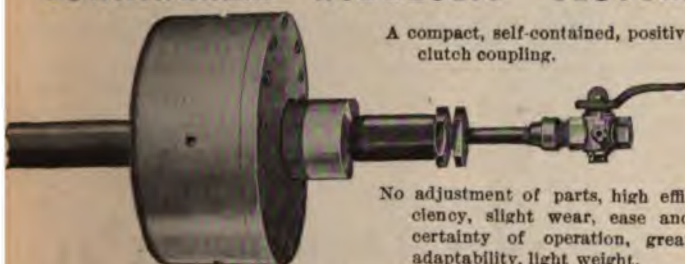

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# THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. VI NEW YORK, JUNE 6, 1900. No. 10.

## THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

HERBERT LADD TOWLE, Associate Editor.

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**On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.**

The Acetylene Motor Number will contain all the most up-to-date information regarding the generation of Acetylene, its cost, fuel value and storage, and the experiments thus far made with it in internal combustion motors.

## Some Instructive Diagrams.

In this country electric ignition is used on motor vehicles to the substantial exclusion of other methods of starting combustion, and it is therefore not for the direct applicability of Professor Magruder's article on "The Gas Engine Hot Tube as an Ignition Timing Device" to motors of this class that we have reprinted it in full, with only the omission of the less important diagrams. The electric igniter has its own pet weaknesses, but, unless possibly in some varieties of "wipe" sparkers, irregular timing is not one of them. To produce a spark at a given moment is a mechanical proposition of the most concrete kind, and the only pitfall of consequence in this connection is to be found in the hammer-blow class of igniters, in which a certain fraction of time must elapse between the releasing or tripping of the hammer and the delivery of its spark-producing blow. As the hammer starts from rest, and as it must have a certain amount of stored energy, or a certain minimum of velocity, when it strikes the electrode, in order to effect a quick break, it follows that the spring impelling and accelerating it must act through a certain minimum interval of time. This interval must be allowed for in timing the spark, and as it is a constant the spark will occur later at a high engine speed than at a low speed. With the time between the tripping and the blow once fixed experimentally, the necessary lead for different speeds can, if desired, be calculated, and provided for by either automatic or manual adjustment.

But though the motor vehicle builder is not concerned with the various temperatures, leakages, mixtures and pressures which affect the automaticity of the hot tube, we yet believe that the article concluded in this issue, and especially the diagrams, will be found of great, even if indirect, suggestiveness. One of the most striking features of the series as a whole is the evidence it gives of the great influence of the moment of ignition and the rapidity of combustion on the amount of energy converted into work. In such extreme cases as those shown in Figs. 16 and 18, on the one hand, or in Figs. 39 and 65, on the other, the working of an abnormally early or late ignition is well enough known. In the former case the premature rise of the combustion curve represents negative work, which, owing to the needlessly early exposure of the burning gases to the cooling influence of the walls and head, with the resulting loss of heat, cannot be recovered on the out stroke. In the latter case much of the power is developed too late to be of use, and in aggravated cases the release may take place at an excessive pressure. But there are many instances where an advance or retardation of the ignition moment may be too slight to change the beginning of the combustion curve perceptibly, but may yet produce a palpable effect on the upper course of that same curve, since the inflammation spreads far more rapidly while the piston is at the dead point than after it has begun to move out.

The present writer has frequently urged the inexpediency of too rapid combustion in water-jacketed cylinders of

moderate size, on the ground that an excessive amount of heat was liable to be sacrificed to the jacket water before the piston had an opportunity to convert it into work. It would seem as if no better evidence in support of this argument could be adduced than these diagrams show. The engine in question was of 6-in. bore by 12-in. stroke, and the clearance volume is stated to have been 33.99 per cent., or practically one-third, of the piston's displacement. This, if the cylinder took a full charge at atmospheric pressure, would have resulted in a compression of about 100 lbs. absolute. In reality the compression curve of the "normal" cards does not begin to rise till the piston has traversed about one-third of its stroke, and the compression is never above 75 lbs. absolute, while it frequently runs 5 lbs. or more below that. Even that is high enough to make a good mixture burn very rapidly; and as a matter of fact, if the diagrams are to be trusted, it would appear that in nearly all cases the combustion was too rapid for the best efficiency.

It is very probable that in a number of these cards the inertia of the indicator piston is partly responsible for the abnormal "peaks" exhibited, in which the first portion of the expansion curve follows directly back on the explosion curve, or even forms a loop with it; and in some cards the height of the peak or the wavy character of the curve would seem to demonstrate this. But there are other cards which do not suggest this inertia; and a careful study of the whole series leaves a conviction that a substantial percentage of energy, not less than 5 and sometimes nearer 10 per cent. of the best possible M. E. P., was lost that might have been saved.

This being admitted, it is an interesting question, what means should be used to secure the desired lengthening of the combustion period. The mixture seems to have been quite homogeneous, and it is doubtful if benefit would result from stratifying it. The diagrams are hardly conclusive as to the feasibility of making the ignition later than it is—a point more readily secured with the electric spark than with the hot tube; but there is no doubt that such a delay would be beneficial. One of the best cards in the series is the upper one, in Fig. 57, taken when there was, apparently, an excess of gas. The other cards taken under heads 14 and 15 point to the same thing—that a lean mixture ignites sooner than a normal one, and apparently burns faster also, and that a rich mixture produces a better diagram. It is probable that the excess of gas was not justified by the increased power, but it is to be regretted that the consumption was not measured in these cases. All things considered, it seems likely that unless the ignition could be made to occur a little later than it does in most of the "normal" cards, it might have been well to reduce the compression somewhat.

The phenomenon shown in Figs. 24 and 25, where a leak by the piston does not sensibly affect the timing, while a leak by the valves does, is certainly curious; but it is hardly more curious than the other fact that while the compression in the former cases is about 48 lbs., and that in Figs. 29 and 31 is only about 38 lbs., the M. E. P. in the former is notably less than in the latter. Probably the higher compression in the former case, aided possibly by some unnoticed factor, caused a combustion rapid enough to drive out a larger percentage of burning gases through the leak.

The project to start a national association of automobilists seems perhaps rather premature. Local organizations are being formed as fast as there is a demand for them, and for some time they will have enough to do at home. When the time is ripe these bodies will affiliate into a national organization, which will be able to cope with all questions and will have the prestige and support of its corporate members besides. A new organization, working at cross purposes with the old, will be of doubtful benefit.

## The Automobile Club's Philadelphia Run.

The Automobile Club of America carried out its Philadelphia run last Saturday according to the programme. Eight locomobiles, four Wintons, three Riker carriages and two Columbia electrics started from the Waldorf-Astoria at 7:30 a. m. E. Schwartzkopf went in his fore-carriage gasoline 'bus, carrying six passengers and all the baggage. The Automobile Co. of America entered one gasoline break, which stopped at Staten Island, owing to a broken clutch. George F. Chamberlain, president of the club, was the first to reach Philadelphia, arriving at the Bellevue Hotel in his Winton carriage at 7:20 p. m. Sixteen minutes later the second Winton arrived, with Percy Owen driving, and the locomobiles and others followed. Mr. Schwartzkopf arrived late, after several minor breakdowns. Two of the Riker carriages arrived late at night, having been "recharged" en route. The third, which was Mr. Riker's racing machine, sustained a short-circuit between Trenton and Princeton, and the two Columbias disappeared somewhere and were not heard from.

The run was not supposed to be a race, but it quickly degenerated into a scramble for Philadelphia. Mr. Chamberlain and several others stopped at Princeton at noon, and waited till nearly 4 o'clock for the stragglers. Several heavy showers delayed the run between Princeton and Philadelphia, and all hands reported the road between Moorstown and Philadelphia to be the worst they ever rode on. The club was lavishly entertained by the Philadelphia organization, with every possible courtesy in the way of charging, repairs, etc.

The sale of the John Stephenson Co.'s plant, advertised in THE HORSELESS AGE to take place April 25th, was, for the best interests of all concerned, postponed to a later date. Several postponements were made, but the sale is now definitely announced to take place at Bay Way on Tuesday, June 12th, at 2 p. m. sharp.

**ACETYLENE MOTOR NUMBER JUNE 20.**

## The Boston Woods Motor Vehicle Co.

A rival for the Lead Cab Co., which has dominated the public electric carriage service in Boston for more than a year, has now appeared on the horizon, and before the hot weather is far advanced promises to be bidding for business in the aristocratic Back Bay and perhaps at the railroad stations. The new company is to use the Woods motor vehicles.

The Woods Co. has been trying for some time to introduce its carriages in Boston, not only for public service, but also for general sale. For a time it appeared that J. H. Behneke, of the National Transportation Co., would head the company, and negotiations with him were pending for some time, but failed to go through, largely because the men concerned were not willing to put up enough capital to satisfy the Woods Co.

Now it appears that an entirely different set of men, well known in Boston, have organized a company. Samuel L. Powers, counsel for the New England Telephone & Telegraph Co., appears as the president; H. W. Mason, a Milk St. lawyer, as the treasurer, and among the directors are Charles T. Gallegher, a well-known lawyer; General William A. Bancroft, president of the Boston Elevated Railway Co., and Melvin O. Adams, another railroad president.

The capital stock is to be $300,000, of which $60,000 is said to have been paid in. An order for the first consignment of cabs has been placed with the Woods Co., and before the end of the month it is said that 20 will be ready for use. Two cabs, a delivery wagon and nine pleasure vehicles have been circulating in the city for about a fortnight, having made their headquarters at the station of the Edison Illuminating Co. on West Canton St., which was the station used by the New England Electric Vehicle Transportation Co. when it started. This, however, is not large enough for a regular carriage business of ordinary proportions, and the new company is negotiating already for a central station in the down-town district, not far from the Hotel Touraine, the center of automobile travel. It will have a sales department there too, and will make the sale of delivery wagons an important feature. The rival company merely leases its wagons here, while the Woods vehicles will be sold outright. One of the delivery wagons has been undergoing trial by a large clothing house on Washington St.

There is a possibility that the new company will devote itself almost altogether to the sales business at first, leaving the operation of its cabs to a sub-company, though this has not yet been decided. As yet only a single cab has been in service here at one of the popular Back Bay hotels.

The Woods Co., having been debarred from using the recharging station of the Lead Cab combination, is said to include in its general plans a scheme of recharging stations located all around the city at convenient points. At these stations the plan is to sell power to all electric vehicles drivers, irrespective of the make of carriage. The company will also, by these branches, be able to extend the operation of its cab and delivery wagon service. The name of the new company is the Boston Woods Motor Vehicle Co., and it is said to be entirely independent of the General Carriage Co., which is to operate Woods cabs in New York City.

---

Albert C. Bostwick has been elected a member of the Automobile Club de France.

The Diamond Rubber Co. is sending a decorative hanger in colors to its customers and friends.

## Gordon-Bennett Race, June 14.

The uncertainty which has been felt as to whether the Gordon Bennett Cup race would be permitted has been definitely set at rest by the assurance of M. Waldeck-Rousseau, Minister of the Interior, that it will be authorized. The assurance was given to the Comte de Chasseloup-Laubat and MM. Jeanteaud and Ravenez, in a personal interview. The date for the race is reported to have been fixed as June 14.

## Secession from the Automobile Club of France.

The leading topic of conversation in Paris sporting circles just now is the split in the ranks of the Automobile Club. It is said in explanation that that organization has grown from a sporting fraternity into a social club, spending so much time and money on fêtes, dinners and elaborate service that its original object, the encouragement of the industry and of racing, has seriously languished. Trouble has been brewing for some time, and when, on May 29, the Baron de Zuylen announced that out of a budget of 361,000 francs only 5,000 would be allotted to racing, a crisis was reached. About fifty members, many of them of long standing, resigned from the club and at once started a new organization, the Moto Club de France. Their numbers are rapidly growing, and Pierre Giffard, one of the leaders of the movement, described its purpose thus in conversation with a representative of the New York Herald:

"We mean to be democratic to the backbone. There will be no club house; simply a spacious apartment at a yearly rental of about 5,000 francs ($1,000). Our aim is to encourage the automobile industry, and, our expenses being small, we shall have, for I am certain of success, a considerable sum to distribute yearly for racing purposes. No one with an honorable reputation will be refused admission. Even professional races and the employees of our factories will all be welcome, and we shall look after their interests.

"One of my colleagues overheard yesterday on leaving the Automobile Club de France one high-toned member saying to another:

"'Ces messieurs vont faire l'Automobile Club des Pauvres.'

"That is just it, and we glory in our shame. As for the Automobile Club de France, we wish it good fortune. There is no animosity.

"One thing is certain. We shall have all the sporting arrangements in future, for where Paul Rousseau is there the sportsmen will gather."

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The Horseless Age has received letters from De Witt C. Morrell, Equitable Building, New York, proposing the formation of a national association of automobilists, organized somewhat on the lines of the L. A. W., and with similar objects in view. Circular letters have been sent to a number of automobilists and manufacturers, and the replies are reported to be encouraging. It is stated that a national convention for organization will be called before long.

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# Acetylene Motor Number June 20.

# The Gas Engine Hot Tube as an Ignition Timing Device.*

By Wm. T. Magruder, Columbus, O.

(*Concluded.*)

8. WHETHER THE EXHAUST VALVE LEAKED OR NOT.

Fig. 31 shows that the ignition was later when the handle was horizontal than when it was vertical, and that the effect of causing the exhaust valve to remain open, even a slight amount, during the entire stroke, was to reduce the average mean effective pressure from 72.68 lbs., when the handle was vertical, to 62.175 lbs., when the handle was horizontal. The conclusion therefore is that any leaks about the inlet or outlet valves cause the ignition to take place later.

9. THE TEMPERATURE OF THE JACKET-WATER OUTLET.

Figs. 33 to 38, the cards of Run 149, would seem to indicate that at constant speed the higher the temperature of the jacket-water outlet the earlier is the ignition; but that with constant and excessive load, so that the governor hit every time and did not miss an ignition, the speed of the engine increased from about 180 revolutions per minute to 280 revolutions per minute as the temperature of the jacket-water outlet increased from 60 degs. Fahr. to 200 degs. Fahr., the inlet temperature being 49 degs. With this highest outlet temperature, the amount of water circulating was so small and the valves were so nearly closed that any slight change in the water pressure, so as to produce a corresponding change in the quantity of water circulating, caused a marked decrease in speed.

10. THE TEMPERATURE OF THE MIXING AND IGNITION CHAMBERS.

Figs. 39, 40 and 42 illustrate how the time of ignition gets earlier as the engine gets hotter, the speed and jacket-water temperatures remaining constant.

11. THE SPEED OF THE ENGINE AT CONSTANT JACKET-WATER OUTLET TEMPERATURE.

Fig. 43, Card No. 30 of Run 148, shows that the time of ignition is earlier with the slower speeds, and that above 275 revolutions per minute with this engine, no change in time of ignition could be discovered. This latter result was probably due to a small change of crank circle arc at the dead center not being easily calculated when measured by its diametral projection.

12. THE TEMPERATURE OF THE HOT TUBE.

It is self-evident that the hotter the hot tube, the more quickly will the gases be heated up and become inflamed, and therefore the earlier will be the ignition, and vice versa. Fig. 65 illustrates the effect of a change in the temperature of the hot tube by a series of diagrams of consecutive ignitions, showing that the cooler the hot tube the later was the ignition. It should also be noted that each ignition curve starts from a different point on the compression line, and that the expansion lines and terminal pressure were higher the later was the ignition.

13. WHETHER THE PREVIOUS STROKE HAD BEEN MISSED OR NOT.

Figs. 44 and 45 illustrate the fact that with a 4-cycle engine with a hit-or-miss governor, and taking air every other revolution, the time of ignition is earlier after an ignition has

* Read before the American Society of Mechanical Engineers, Cincinnati, May, 1900.

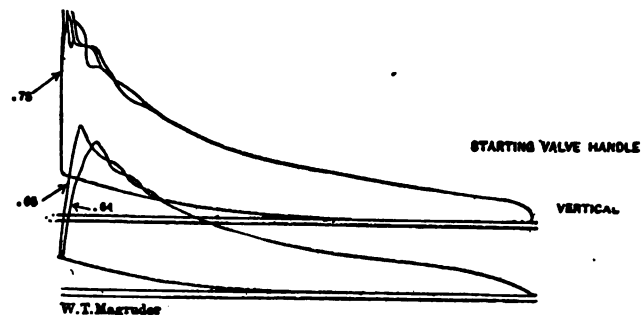


FIG. 31.

Run No. 150. Date March 25, 1899. Time 4:32 P.M. No. 2. Spring 240. Length 2.46. Area .75 and .65 to .64. R.P.M. 280. X.P.M. 140. M.E.P. 73.17, 63.42, 62.44. I.H.P.——.

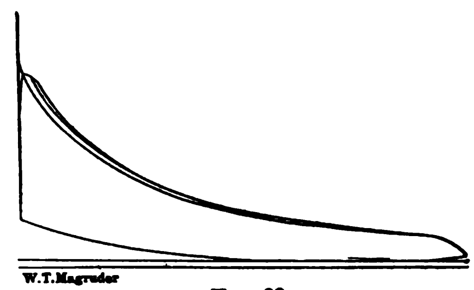


FIG. 33.

Run No. 149. Date March 21, 1899. Time 4:17 P.M. No. 1. Spring 240. Length 2.45. Area .68. R.P.M. 180. X.P.M.——. M.E.P. 66.61. I.H.P.——. Gas Cock at 10. 60° F. J.W. Outlet. 2-in. Air Inlet.

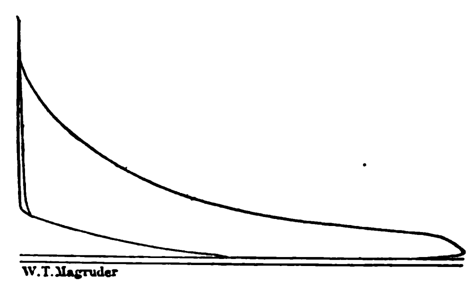


FIG. 34.

Run No. 149. Date March 21, 1899. Time 4:34 P.M. No. 10. Spring 240. Length 2.44. Area .65. R.P.M. 212. X.P.M. 106. M.E.P. 63.94. I.H.P.——. Gas Cock at 10. 60° F. J.W. Outlet. 2-in. Air Inlet.

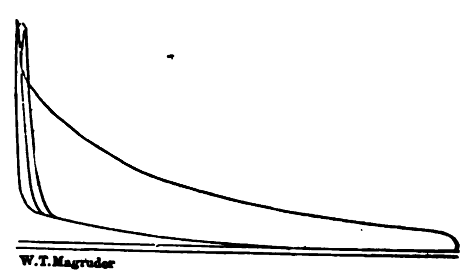


FIG. 35.

Run No. 149. Date March 21, 1899. Time 4:51 P. M. No. 17. Spring 240. Length 2.46. Area .6. R.P.M. 240. X.P.M. 120. M.E.P. 58.54. I.H.P.——. Gas Cock at 10. 174° F. J.W. Outlet. 2-in. Air Inlet.

been missed and the burnt gases have been scavenged by fresh air. These cars also show why it is that the gas consumption per indicated horse-power per hour is so much greater with frictional or light loads than with heavy loads.

### 14. THE PRESSURE OF THE GAS.

Figs. 53 to 55 show that, with a constant quantity of air coming through a 1½-in. air inlet diaphragm, the time of ignition was earlier with 3½-in. gas pressure than with either more or less gas pressure; that is, that the mixture so produced was more inflammable: but that the card with 8-in. gas pressure gave the greatest mean effective pressure.

### 15. THE POSITION OF THE GAS-COCK HANDLE.

Figs. 56, 57 and 58, Cards Nos. 2, 3 and 8 of Run No. 145. show that, by changing the gas-cock handle from the wide open position marked "10" to the positions marked "7" and "6," respectively, the ignition was made earlier; that the areas of the diagrams, and therefore the mean effective pressures, decreased correspondingly, and that from a speed of 264 revolutions per minute with the gas cock at 10, the speed of the engine decreased to about 240 if the gas cock was changed to 7.

The conclusion therefore is that with less gas, for the given amount of air, the earlier is the ignition, within certain limits.

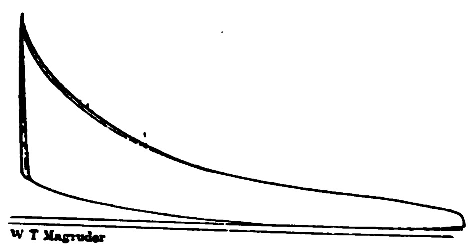


FIG. 37

Run No. 149. Date March 21, 1899. Time 4:56 P.M. No. 20. Spring 240. Length 2.45. Area .69. R.P.M. 268. X.P.M. 134. M.E.P. 67.59. I.H.P. 120 lbs. Net Brake Load. X. Gas 832° F. 192° F. J.W. Outlet.

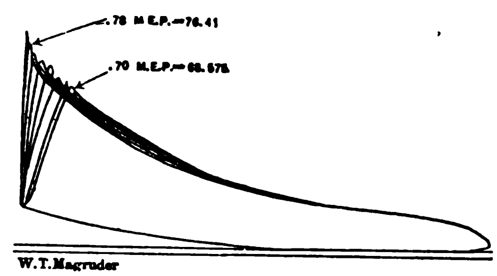


FIG. 40.

Run No. 139BBB. Date Feb. 21. Time 3:11 P.M. No. 4. Spring 240. Length 2.45. Area .78 to .70. R.P.M. 280. X.P.M.——. M.E.P. 76.41 to 68.57. I.H.P.——. 2½-in. Upper Hot Tube. 2½-in. Lower Hot Tube. 110 lbs. Net Brake Load.

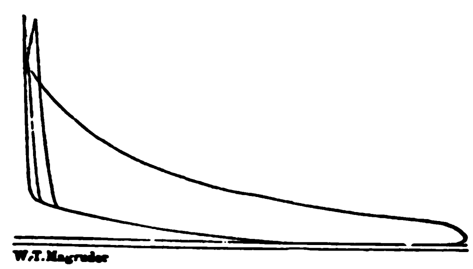


FIG. 38.

Run No. 149. Date March 21, 1899. Time 5:00 P.M. No. 23. Spring 240. Length 2.44. Area .65. R.P.M. 264. X.P.M. 132. M.E.P. 63.94. I.H.P.——. X. Gas 840° F. 205° F. J.W. Outlet.

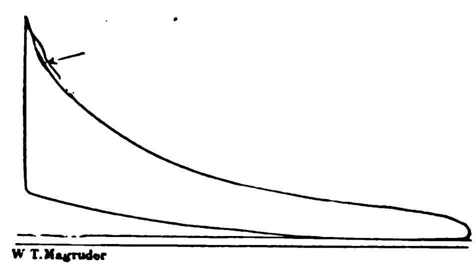


FIG 42.

Run No. 139BBB. Date Feb. 21. Time 3:12 P.M. No. 5. Spring 240. Length 2.43. Area .73. R.P.M. 275. X.P.M.——. M.E.P. 72.10. I.H.P.——. 2½-in. Upper Hot Tube. 2½-in. Lower Hot Tube. 120 lbs. Net Brake Load.

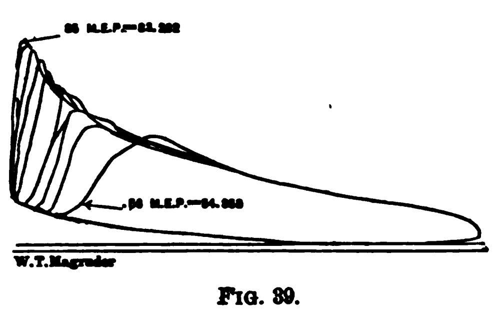


FIG. 39.

Run No. 139BBB. Date Feb. 21. Time 3:07 P.M. No. 2. Spring 240. Length 2.45. Area .85 to .56. R.P.M. 290. X.P.M.——. M.E.P. 83.26 to 54.86. I.H.P.——. 2½-in. Upper Hot Tube. 2½-in. Lower Hot Tube. 120 lbs. Net Brake Load.

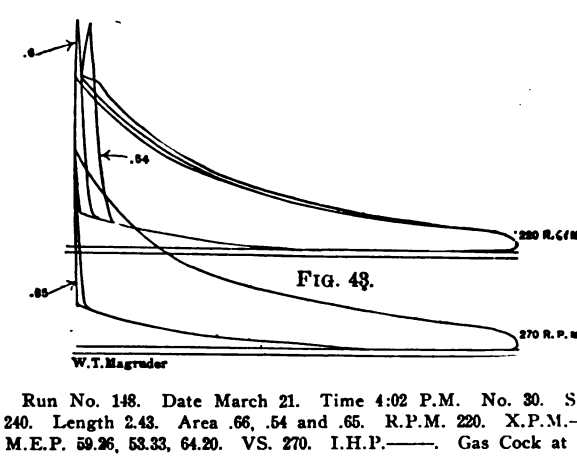


FIG. 43.

Run No. 148. Date March 21. Time 4:02 P.M. No. 30. Spring 240. Length 2.43. Area .66, .54 and .65. R.P.M. 220. X.P.M.——. M.E.P. 59.26, 53.33, 64.20. VS. 270. I.H.P.——. Gas Cock at 10.

Possibly, if later ignition could be secured, by shortening the hot tube, for example, the engine would give more power per cubic foot of gas used.

16. THE SIZE OF THE AIR-INLET DIAPHRAGM.

Figs. 60 to 62, Cards Nos. 10, 12 and 34 of Run 148, show the effect of changing the air-inlet diaphragm from 1½-in. diameter to 1¼-in., and finally to 1-in., as compared with cards obtained when there was no diaphragm in the 2-in. union in the air-inlet pipe, the gas cock being wide open in all cases. The conclusion therefore is that with the gas cock wide open, to throttle the air supply caused the ignition to be later.

17. THE PRESSURE, OR SUCTION, WITH WHICH THE AIR WAS DELIVERED TO THE ENGINE.

In certain of the 25 preliminary tests previously referred to, in order to vary the ratio of air to gas as much as possible, the air was either forced by a pressure blower, or else sucked by the engine, first through an air meter, and then through a 6-in. galvanized iron pipe to the 2-in. air inlet union at the engine. A valve at the inlet to the meter enabled the desired suction or pressure to be obtained. The results then obtained confirm the results recorded in cases Nos. 14, 15 and 16, above, namely, that within limits, the greater the air pressure the earlier is

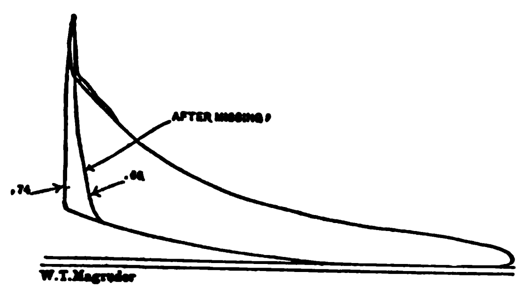


FIG. 44.

Run No. 129. Date Nov. 5, 1898. Time 10:28 A.M. No. 1. Spring 200. Length 2.46. Area .74 and .66. R.P.M. 274 2-3. X.P.M. 115. M.E.P. 72.30, 64.39. I.H.P.——.

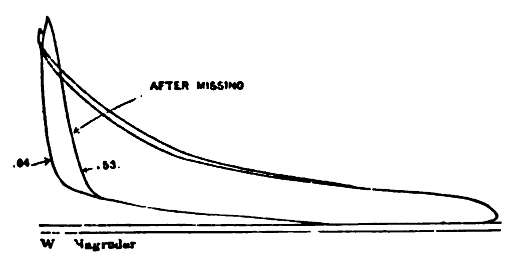


FIG. 45.

Run No. 129. Date Nov. 5, 1898. Time 10:52 A.M. No. 10. Spring 200. Length 2.45. Area .64 and .58. R.P.M. 274 2-3. X.P.M. 115. M.E.P. 62.69 and 56.82. I.H.P.——. 1¾-in. Air Orifice. 4-in. Hot Tube.

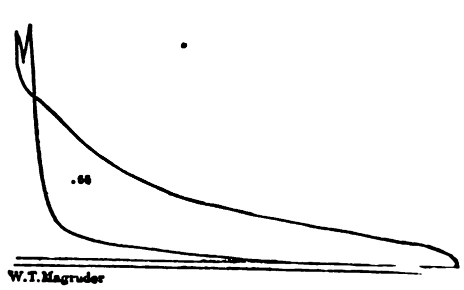


FIG. 53.

Run No. 127B. Date Nov. 5, 1898. Time——M. No. 4. Spring 200. Length 2.45. Area .65. R.P.M.——. X.P.M.——. M.E.P. 62.67. I.H.P.——. 1½-in. Air Orifice. 6-in. Gas Pressure.

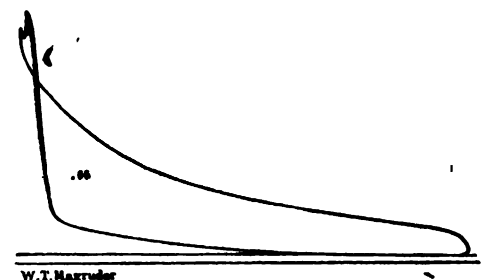


FIG. 54.

Run 127B. Date Nov. 5, 1898. Time——M. No. 3. Spring 200. Length 2.45. Area .55. R.P.M.——. X.P.M.——. M.E.P. 53.88. I.H.P.——. 1½-in. Inlet Air Orifice. 8-in. Gas Pressure.

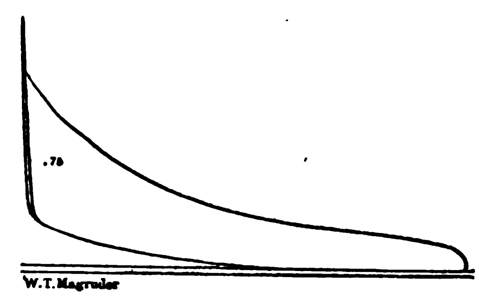


FIG. 55.

Run No. 127B. Date Nov. 5, 1898. Time——M. No. 5. Spring 200. Length 2.45. Area .75. R.P.M.——. X.P.M.——. M.E.P. 73.47. I.H.P.——. 1½-in. Air Orifice. 8-in. Gas Pressure.

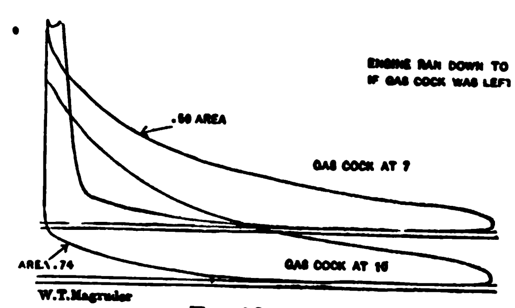


FIG. 56.

Run No. 145. Date March 14, 1899. Time 4:08 P. M. No. 2. Spring 240. Length 2.45. Area .74 to .59. R.P.M. 264. X.P.M. 129. M.E.P. 72.49 to 57.80. I.H.P.——.

the ignition, and also that the greater the air suction the later is the ignition; in other words, that if the mixture be a lean one, the ignition is earlier; whereas if the mixture be a rich one, the ignition is later. In either case, the mean effective pressures of the diagrams and therefore the indicated horse-powers are less, and the consumptions of gas per indicated horse-power will be greater, than if the ratio is such as to give the proper mixture to insure proper timing of the ignition, and the best combustion of the gas. By a "lean mixture" is here meant one in which the volumes of gas and air used are as 1 to 8; and by a "rich mixture," one in which the ratio is as 1 to 4.

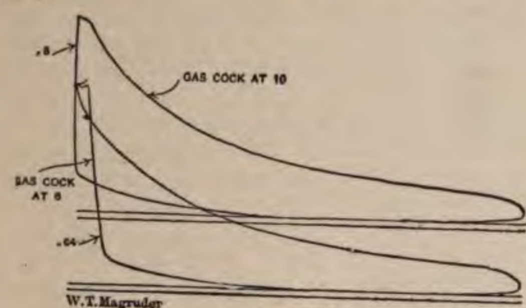


FIG. 57.

Run No. 145. Date March 14, 1899. Time 4:12 P.M. No. 3. Spring 240. Length 2.46. Area .80 to .64. R.P.M. 264, 270. X.P.M. 129, 131. M.E.P. 78.05, and 62.44. I.H.P.——.

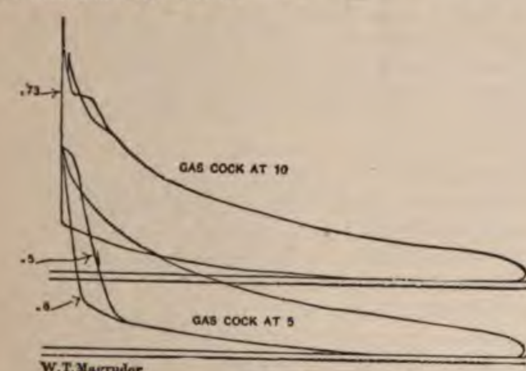


FIG. 58.

Run No. 145. Date March 14, 1899. Time 4:24 P.M. No. 8. Spring 240. Length 2.46. Area .73 to .60 to .50. R.P.M. 268. X.P.M. 134. M.E.P. 71.22, 58.74, 48.78. I.H.P.——.

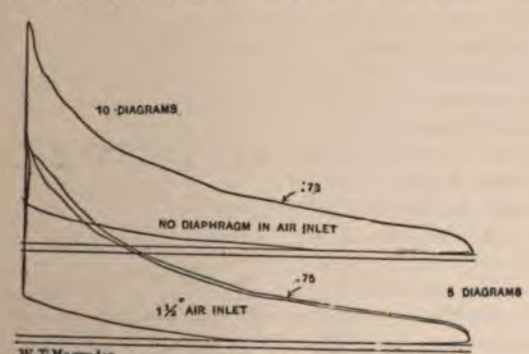


FIG. 60.

Run No. 148. Date March 21, 1899. Time 3:18 P.M. No. 10. Spring 240. Length 2.45. Area .73 and .75. R.P.M. 250. X.P.M.——. M.E.P. 71.51 and 73.47. I.H.P.——. 120 lbs. Net Brake Load. Gas Cock at 10.

Lest the impression should be created that the irregular cards here presented are the usual thing with this engine, Fig. 5 is added as a fair sample of a very regular set of cards, and the following are the average results of the 30-minute run, No. 160:

| | |
|---|---|
| Revolutions per minute | 274.4 |
| Explosions per minute | 131.6 |
| Ratio explosions to double strokes | 95.92 |
| Mean effective pressure | 76.53 |
| Indicated horse-power | 8.63 |
| Brake horse-power | 6.46 |
| Mechanical efficiency | 74.93 |
| Corrected gas per indicated horse-power hour | 19.577 cu. ft. |
| Corrected gas per brake horse-power | 26.129 cu. ft. |

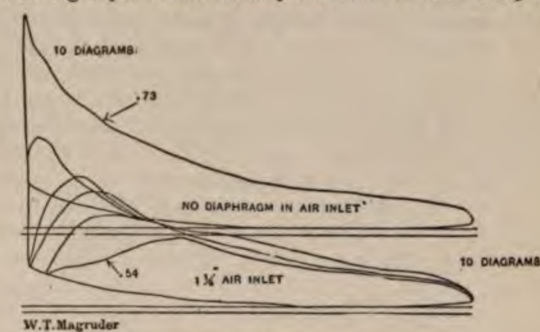


FIG. 61.

Run No. 148. Date March 21, 1899. Time 3:24 P.M. No. 12. Spring 240. Length 2.44. Area .73 to .54. R.P.M. 250 to 200. X.P.M.——. M.E.P. 71.80 to 53.11. I.H.P.——. 120 lbs. Net Brake Load. Gas Cock at 10.

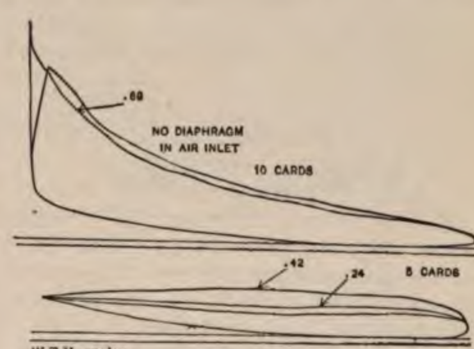


FIG. 62.

Run No. 148. Date March 21, 1899. Time 4:11 P.M. No. 34. Spring 240. Length 2.43. Area .69 to .42 to .24. R.P.M. 235. X.P.M.——. M.E.P. 68.15 to 41.48 to 23.70. I.H.P.——. Gas Cock at 10.

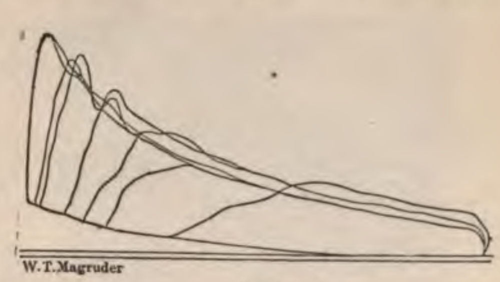


FIG. 65.

Run No. 139AA. Date Feb. 14, 1899. Time——M. No.——. Spring 240. Length——. Area——. R.P.M. 280. X.P.M. 140. M.E.P.——. I.H.P.——.

That these results are not unusual, reference is also made to Fig. 7, previously given, in which the diagrams were repeated or traced 13 times without removing the indicator pencil, and giving 7.50 i.h.p., 5.73 b.h.p., a mechanical efficiency of 76.39, and a corrected gas consumption of 20.44 cu. ft. per indicated horse-power per hour, or 26.76 cu. ft. per brake horse-power per hour.

In English text-books on the gas engine, it is stated that the use of the hot tube as an igniting device is to be preferred to electric ignition chiefly on account of the skill required in keeping up the batteries and keeping the platinum points in working condition. That electric ignition has its indivdual peculiarities and troubles, goes without saying; and that late, but not early, ignition is just as possible with electric methods as with hot tube methods, when the proportion of air to gas is not right. It is well, however, to understand just what the internal ailments are which are likely to affect the open hot tube method of ignition, and hence this study of the subject. It should be said, however, that it does not follow that all hot tube ignition methods and mechanisms are subject to all of the troubles here isolated and described; or that any one engine is likely to be afflicted with all of these troubles at any time in its life. There are a few external ailments, such as not having the hot tube hot enough, which was mentioned above in case No. 12, not having the proper supply of gas and air to the Bunsen burner of the hot tube, the asbestos lining of the chimney not being of the right size, the hot tube itself burning out or becoming filled with soot or tarry matter, or being cracked by drafts of air if of porcelain, and the like, which it is not the purpose of this paper to discuss.

It is thought that a fuller knowledge of the possible external and internal organic troubles of the gas engine will remove it further from the realm of uncertainty to a position where it may be more fully depended upon for economical running and continuous service.

## A Simple Carriage.

The Elmore Mfg. Co., Clyde, O., are builders of the carriage shown in the accompanying cut. They say of it that "We have no gears, cams, clutches, sprockets, chains, valves or other kindred trouble makers, but still have a perfect running carriage. Our engine is valveless and practically requires no attention." The transmission is direct from the engine shaft to the rear tires by means of rubber covered friction pulleys. There are two speeds, which appear to be gained by making the friction pulleys with two steps.

## Automobile Racing at Rochester.

Among the first track races between automobiles in this country, barring tricycles and racing machines, were those which took place on Decoration Day in Rochester, N. Y., at the opening meet of the Flower City Gentlemen's Driving Association. The programme opened with a parade of motor carriages, of which there were twelve in line. This was followed by an exhibition mile in 1:27 2-5 by the Stearns steam racing machine and another in 2:08 1-5 by George Loysen, of Rochester, on a bicycle, paced by the steam machine. A mile race for steam runabouts, three entries, was won by Joseph McDuffie, of New York, in 2:17, defeating the two local contestants. A mile race for electric vehicles was won by C. J. Conolly, of Rochester, in 5:20, and was followed by a 5-mile free-for-all, with flying start. There were five entries, and J. H. Sager, on a quadricycle, led until the quarter post on the fifth mile, when McDuffie forged ahead and won in 14:42½, with Sager second. Another mile by the pacing machine in 1:33 was followed by a mile handicap for all classes of horseless vehicles. McDuffie was scratch, with J. F. Warner, Sager, F. H. Bettys and Conolly having handicaps up to a half mile in the order named. They finished in the same order, McDuffie winning in 2:17. With the public the races were a decided success.

## A Long Service Carbon Brush.

Professor Elihu Thomson, in the course of a recent lecture on "The Properties of Carbon in Electrical Work," read before the Northeastern Section of the American Chemical Society in Boston, supplemented his remarks on the advantages of carbon as a material for dynamo and motor brushes with the following:

"I have had in use on the dynamo of my private house lighting plant a modified carbon brush which has given remarkably good results after various forms of metal brush and even ordinary carbon brushes had been found unsatisfactory. The wear and tear with metal brushes and the frequent burnings were a great nuisance. The potential is 110 volts and the present brushes have fed forward about ⅛ in. in three and one-half years of use, about 7,000 hours. The commutator is still in excellent condition, never having been turned, sand-papered or attended in any way whatever. The brushes are never adjusted after once being set. The commutator and brushes run quite cool. There is apparently no wear of the copper, or so little as to be negligible. There is no grooving, though the commutator during the period above mentioned must have made about 500,000,000 revolutions. The brushes are never shifted and the shaft does not play endwise. There is every indication that the brushes themselves might last fifty years, and the commutator indefinitely long.

"The brushes are each composed of a bundle of carbon rods ⅛ in. in diameter and about 5 in. long. These were separately plated with copper all over, soldered together as a rectangular bundle and then given an outside copper coating, rather heavy. They are held in the brush holders which formerly carried the metal brushes and bear on the commutator in like manner. In this form of brush the resistance of the carbon brush except at its contact with copper segments is practically eliminated, and this probably accounts for the fact that the finger can be held upon the tip of the brush during a run without detecting more than a very moderate warmth. It is certain that no other than a carbon contact could possibly give these results."

## COMMUNICATIONS.

### Asbestos in Gas Engines.

Hollandsburg, O., May 25.

Editor Horseless Age:

Will some reader of The Horseless Age kindly give me their experience in regard to the behavior of asbestos cardboard when used in a gas engine as a non-conductor of heat or for any other purpose—for instance, as a packing?

AUTO.

### Valves and Power.

Portland, Me., May, 1900.

Editor Horseless Age:

Will you kindly advise me through your paper what you would consider the proper size for port and valve openings, both inlet and exhaust, for a four-cycle engine with a cylinder 6-in. diameter by 7-in. stroke, using gasoline for fuel and running 450 turns per minute? Also state what horse-power you should expect it to develop with a combustion chamber 1 in. to 1¼ in. long and 6 in. diameter, the cylinder head being convex, so that the distance from the top of the piston to the center of the head is 1¼ in., and to the side of the head 1 in.

S. F. A.

[The inlet valve opening should be about 2¼ in. diameter in the clear. The exhaust valve may be made either the same size or ⅛ in. or so smaller. If the inlet valve is opened by suction, 2⅜ in. diameter would not be excessive, if there is room to make it so large.

For an engine of the above size, the clearance volume should not be less than one-third the piston displacement or "stroke volume," and it may be somewhat larger in some cases. The space above the piston in the case described is therefore only about half of the total clearance necessary. A good 6 x 7 in. four-cycle engine will develop 7 to 7½ b.h.p. at 450 revolutions per minute.—Ed.]

### The Needle in the Haystack.

May 28.

Editor Horseless Age:

The article in your last number on "Necessary Gas Engine Conditions" tempts me to give your readers the benefit of a little practical experience which I have just had in the running of a gasoline motor car. In all my experience as an engineer I know of no mechanism so given to developing new species of "bugs" as the gas and gasoline engine. In no mechanism is the exact cause of the trouble so difficult to locate, and in none is it, usually, so easy to remedy when once found. Mr. Cooper correctly says that with the mixture, compression and ignition in good order the engine is sure to go. This is broadly true, provided the engine is sound mechanically. While the compression can be easily tested, it will be seen later how one can be fooled as to the other points. A few weeks ago I took a 35-mile ride to a friend's house in an adjoining town, carrying with me one other person and an extra 2-gal. can of gasoline out of a new case. The motor car, a French one recently purchased, had been used a month and had never sulked. The run was accomplished in less than two and one-half hours, and after giving my friends a few runs it was put in the stable for the night. The next morning, upon taking a short spin, after filling the gasoline tank from the new can, it was found that the motor would not run up to speed, but would miss explosions as soon as about 12 miles an hour was reached. On hills, however, it would not miss at all. As the battery was new and all joints had been soldered, it was not thought to be the spark; also everything pointed to dirt in the (Longuemare) carbureter. Accordingly, all the gasoline piping was disconnected and cleaned out; also the carbureter. Still the trouble continued, and, while the motor never stopped, yet it acted badly enough to give one "that tired feeling" well known to chauffeurs. However, as it seemed to like hill climbing, I started for home and arrived there in a little over three hours. For the next week I alternately used the machine and took various parts of it to pieces in the effort to locate the trouble. I cleaned with the greatest care the entire gasoline and mixture system, tested the gasoline, ground both valves, jacked up the rear wheels and ran the motor at a high speed by outside power while watching the spark through an opening in the cylinder, but it was as regular and as "fat" as could be desired. The one point that puzzled me was, Why should it go up hills and not miss fire, when it would miss fire at the same speed on the level? This it would do unfailingly, and no amount of cleaning and new parts seemed to have the slightest effect. While the missing of explosions could be produced by a loose connection in the wires, yet I had tested these by actual running and by instruments; and why should it be any different when going up hills? Finally I became convinced that the trouble was electrical. This conclusion was arrived at, first on general principles, and secondly as there was nothing else left to blame it to. As a last test (before selling) I tested out the primary and secondary windings of the coil; then I placed a sensitive galvanometer in the battery circuit and went over each wire and bent and shook it, and it was not until I came to the battery box that I obtained any indication from the needle. Here I found a wire which if shaken just right would cause the needle to go to 0. An examination disclosed the fact that one of the battery terminals was loose under the soldered joints, and in five minutes the trouble was fixed. Why did the machine go up hill without missing fire? The answer is easy now: The cells of the battery leaned back against each other and made contact.

E. T. B.

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# OUR FOREIGN EXCHANGES.

## The Darracq Voiture with Bollée Motor.

In an annex of the factory where the "Perfecta" attachments are made, at Suresnes, M. Darracq builds in series 500 voiturettes at a time under the latest patents of Léon Bollée.

Our illustration shows that these vehicles retain the light form of the voiturette, while their four wheels give them greater stability and an elegance of appearance not shared by the early Bollée voiturette.

The motor of these vehicles is horizontal, with one cylinder and with radiating ribs, and develops in the neighborhood of 5 h.p. It is located near the front of the vehicle, where the air currents will assist in the cooling. As seen in Figs. 1 and 2, the admission valve is automatic, and the exhaust valve is opened mechanically by an eccentric acting on an oblique rod and a bell crank. This rod is controlled by a fly ball governor connected with a sleeve bearing on a lever which is seen at the front of the crank case (Fig. 1). This lever, when the speed is too great, deflects the oblique rod just mentioned so that it does not engage the finger of the bell crank, and the exhaust valve remains closed.

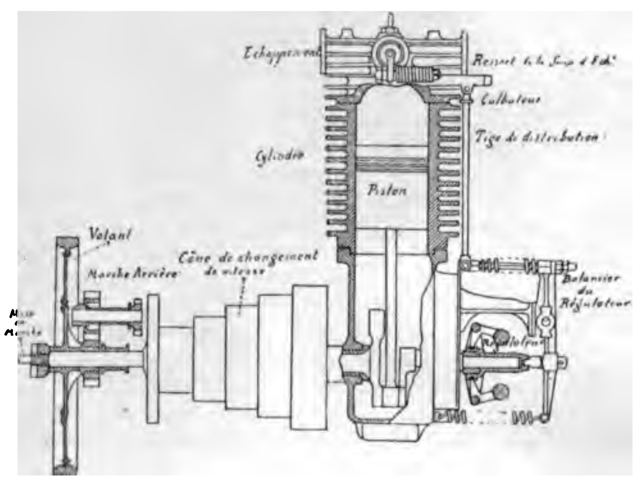



FIG. 1.

The motor shaft carries a five-step cone pulley on its left-hand end, and a shifting belt transmits the power to a conjugate pulley on a secondary shaft in the rear of the frame. The driving cone, however, is not keyed to the motor shaft; it is loose, and when shifted along the shaft toward the motor it is engaged by a driving stud, which provides the forward speed. When shifted away from the motor it engages the reverse motion, which is seen (Fig. 1) next to the fly wheel, and is thereby revolved in the opposite direction.

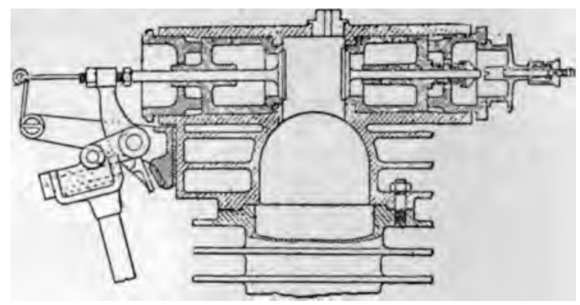


FIG. 2.

The secondary shaft, carrying the driven cone, is mounted in a separate frame below the main frame and movable in a direction parallel to it. By means of a screw operated by a small hand wheel this frame may be adjusted forward or back to allow for shrinkage and swelling of the belt due to changes of weather. A conical friction pulley on the secondary shaft transmits the power from the belt cones. The belt is shifted for changes of speed by means of a rack and pinion and a double fork controlled by the hand-spoked wheel just below the steering wheel, and mounted on a tube around the shaft of the latter.

The oil tank has three compartments, one supplying the flame for the hot tube igniter, the second containing the fuel for the carbureter and the third for the cylinder oil.—La Locomotion Automobile.

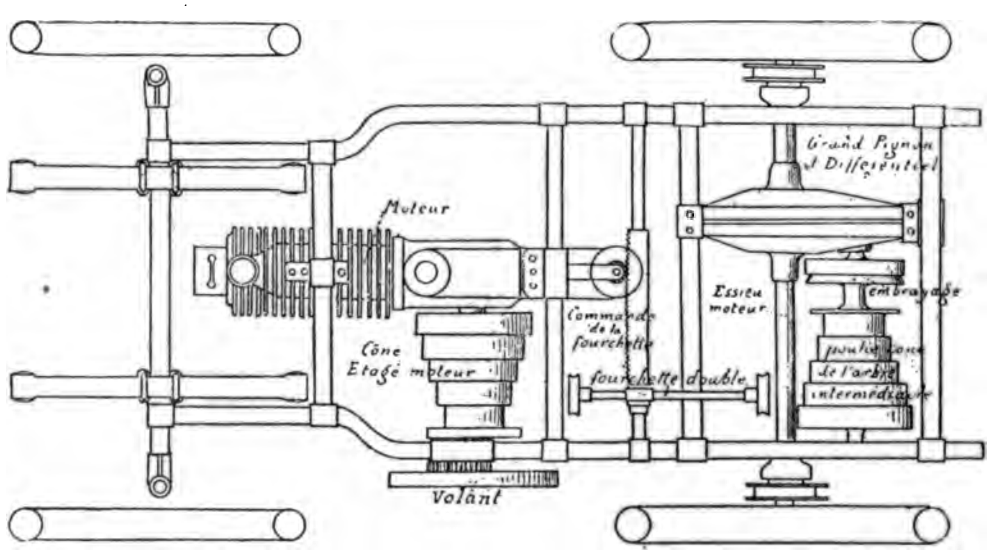



FIG. 3.

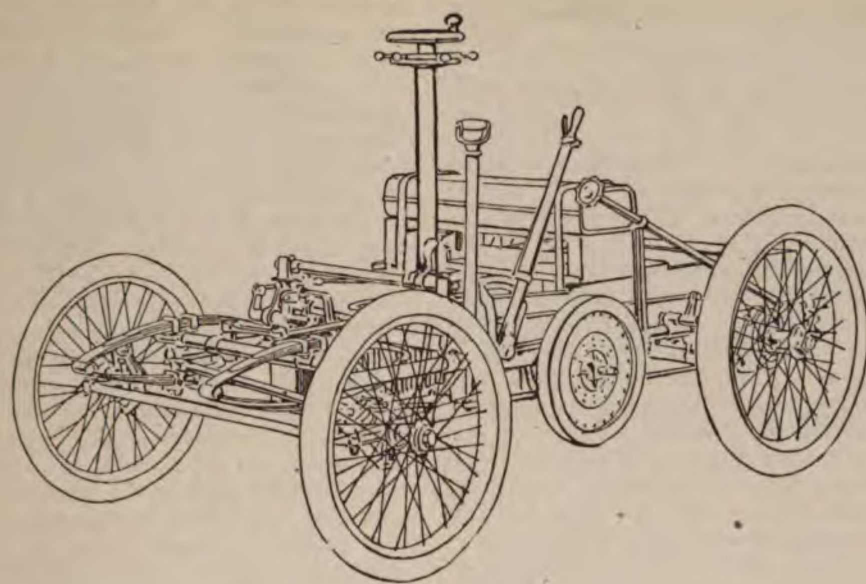


FIG. 4.

## The Lubrication of Motor Vehicles and Cycles.

Under the above title Mr. J. Veitch Wilson has written a most interesting and useful pamphlet, which has been published by Price's Patent Candle Co., Ltd. It is unnecessary to remind automobilists of the importance of using good lubricants upon their machines, and particularly for the motor pistons, because most if not all owners of motor vehicles are only too well aware of the great differences which arise in the working of their cars, according to the value of the oil which is used. For oil motors provided with water jackets, and even more so for those fitted only with air cooling radiators, the employment of inferior lubricating oil is bound to lead to trouble, both in consequence of the continual frictional losses of the fast-moving piston in the cylinder and also because of the sticky formation which soon results from the action of any excessive heating. Mr. Wilson has evidently studied the question most thoroughly, and has enabled his company to produce two grades of oil specially suitable for high-speed oil engines. Both these grades have a much greater viscosity than the gas engine oil which they have been supplying for some years, and which has proved so successful for the ordinary stationary engines.

The following table gives a good idea of the properties of these lubricants, together with those of a heavier gas engine oil which is also prepared by the same company:

TABLE SHOWING PROPERTIES OF OILS FOR GAS AND OIL ENGINES AND MOTORS.

| Oils. | Specific* gravity at 60° F. | * Viscosity at 70° F. | 120° F. | 180° F. | 212° F. | Flash point open. | Setting point about |
|---|---|---|---|---|---|---|---|
| Heavy gas engine oil.......... | 905/910 | 750 | 150 | 45 | 33 | 400 | 32° F. |
| Motorine A...... | 890/895 | 2750 | 435 | 100 | 65 | 550 | 40° F. |
| " B...... | 890/895 | 2000 | 340 | 85 | 55 | 500 | 40° F. |

*The figures given for viscosity denote, in seconds, the time taken by 1,000 grains of oil to flow through a small orifice in the testing apparatus at each temperature. The standard adopted for viscosity in this table is genuine sperm oil, which is taken 100 at 70° F.

Mr. Wilson deals with the question of lubrication in a very clear and concise way. He says: "The difference between ordinary stationary gas or oil engines and motor oil or spirit engines consists primarily in the smaller size of the cylinder, the greater number of explosions per minute, and, consequently, the greater piston speed in the case of motor engines, differences which obviously tend to produce a much higher working temperature in the latter. In addition to these differences, which are common to all motor (oil or 'petrol') engines, another difference between stationary gas engines and the greater number of (but not all) motor oil engines is found in the fact that while all stationary gas engines are provided with a water jacket, which keeps the temperature of the cylinder down, the cylinders of the smaller motor vehicles, in which it is desirable to restrict the weight as far as possible, are not jacketed, and depend for the reduction of temperature entirely upon atmospheric radiation, and frequently, even when fitted with radiator plates to promote the action of the atmosphere, become red hot while at work.

"A little consideration of the distinguishing features of steam, of gas or oil, and of motor engines enables us to recognize the peculiar conditions associated with motor engines and to formulate the properties required in lubricants to meet these conditions. The most important of these is undoubtedly the high working temperature of motor cylinders, due partly to the heat of the explosions and partly to the high friction equivalent resulting from the great speed of the piston. But the natural deductions from this condition must be qualified by the two following considerations:

"(1) That the total frictional surface and the weight of a motor piston are much less than those of stationary gas or steam engines.

"(2) That the arrangements usually adopted for introducing oil to the cylinders of motor engines require an oil which is fluid and easily propelled through a small bore tube at normal temperature.

"The effect upon ordinary animal or vegetable oils of such heat as may be encountered in the cylinders of motor engines would probably be to partially decompose the oils, resolving them into their elements as stearic acid and oleic acid, and

the conversion of these into pitch. Animal and vegetable oils are therefore inadmissible.

"Mineral oils are not decomposed by heat. At certain temperatures, called their 'boiling' points, which vary according to the kind and quality of the oil, they are converted into gas, but resume their original liquid form without any chemical change as the temperature falls. The behavior of mineral oils when exposed to heat varies greatly, not only in respect to their boiling or volatilizing point, but in respect to loss of body at high temperatures. It is obvious that any oil, the boiling point of which is in the neighborhood of the working temperature of the cylinder in which it is to be used, is useless as a lubricant, as, even should it in part retain the form of oil, its body must be so attenuated as to be valueless as a medium in the reduction of friction. But although the boiling point of an oil may be so high as to insure its stability at ordinary working temperatures, it is still possible that its body may have been so much reduced at that temperature as to render it wholly inefficient for the purpose for which it is intended. It is therefore essential that the oil to be used in the cylinder of a motor engine should not only have a boiling point well above that of the working temperature of the cylinder, but that at that temperature it should retain sufficient body to insure the presence of an effective film of oil between the walls of the cylinder and the piston.

"It is at this point, and in considering the body or viscosity of oil required for motor cylinders, that the qualifying conditions previously mentioned claim attention in respect:

"(1) That although the temperature of a non-jacketed motor cylinder may, and at the moment of explosion certainly does, exceed that of a steam cylinder, the smaller size and the lighter weight of the motor piston to some extent counteract the effect of the greater heat, and dispense with the necessity for a thicker oil.

"(2) That, even if it were desirable and possible to obtain a higher viscosity in the cylinder at working temperatures by the use of oils of exceptional thickness at normal temperatures, or of any kind of solidified oil or grease, the use of such materials would be precluded by the impossibility of passing them through the ordinary lubricating connections.

"From these various considerations we are led to believe that the essential properties required for the lubrication of non-jacketed motor cylinders may be stated as follows:

"(*a*) That the oil must not be liable to decomposition with liberation of acids, and production of pitch at working temperatures.

"(*b*) That, if of mineral origin, it must not volatilize to any considerable extent, nor emit offensive fumes, at working temperatures, nor produce carbonaceous deposits in cylinders or valves.

"(*c*) That the body at working temperatures ought to be equal to that of a good steam cylinder oil at similar temperatures.

"(*d*) That it must be sufficiently fluid at normal temperatures to permit of its easy introduction to the cylinder or crank chamber by the ordinary appliances.

"It seems almost unnecessary to say that in the preparation of heavy gas engine and of 'Motorine' we have carefully followed the principles successfully adopted in the production of standard gas engine oil, and analysis will at any time show that in respect to chemical constitution these three oils are absolutely identical, the differences in physical properties—e. g., specific gravity, viscosity and flashing point—being obtained solely by the selection of materials varying in these respects, but otherwise of uniform character."

Although "Motorine" is intended for use under extreme conditions of heat, and although for other reasons it is the object of motor manufacturers to construct oil motors which will remain comparatively cool when working, yet the advantages of a lubricating oil of this quality for use with any oil motor and even with high speed steam engines are by no means small.

We have recently been able to test these high grade lubricants both under the usual running conditions and also upon old experimental motors. With the former machines we were agreeably surprised at the small quantity of oil that was necessary in order to enable the motor to work freely and smoothly, but the results obtained from the latter considerably exceeded our expectations, and conclusively proved the really wonderful value of the lubricant employed. Two instances will suffice to show the general effect of "Motorine" under extreme conditions. Upon one old motor, fitted with a water jacket, the temperature was allowed to rise until after the fact had become only too obvious that solder had been freely used in the construction of the jacket; although the cylinder was red hot and pre-ignition was occurring, yet no symptoms of distress—such as the usual coughing sound—were perceptible; upon examination the piston, rings and cylinder surface were found to be unaffected by this trial, and to work quite freely. A second experimental motor, in which the piston rings had worn so much that the compression was largely lost, was lubricated with "Motorine A." In this case it was found that the power of the motor was immediately and materially increased, owing to the reduction of leakage past the piston.—The Automotor Journal.

## The Bourzac Two-Cycle Motor.

A novel arrangement of two-cycle engine is shown by La Locomotion Automobile, from which we take the following:

The pistons C are connected by short links to the central rocking lever D. This arrangement renders the angularity

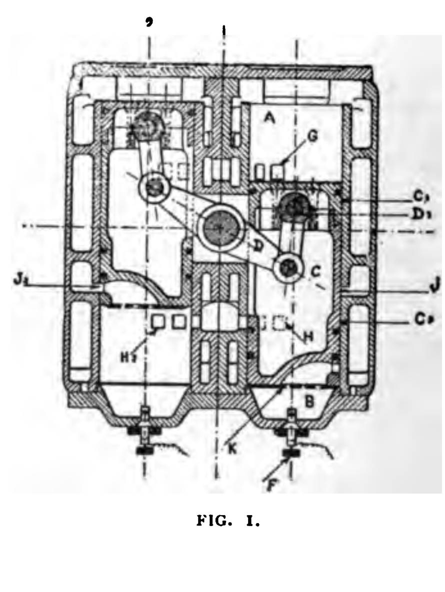


FIG. 1.

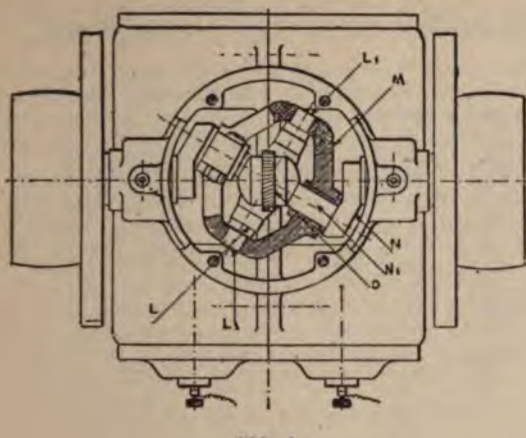


FIG. 2.

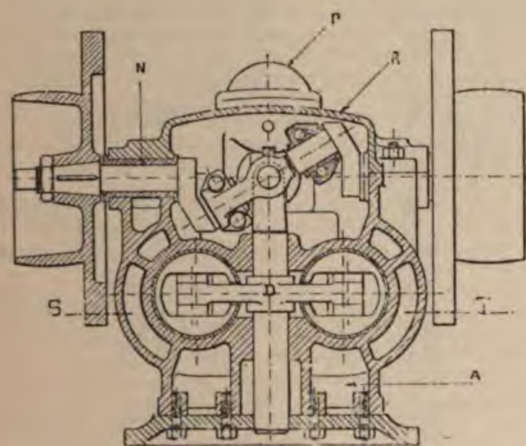


FIG. 3.

of the links very slight and does away almost entirely with the lateral reaction or thrust on the impulse strokes. The piston has two working ends, the chamber A acting as a pump, while the explosions take place in B. The former communicates freely with a sort of reservoir, A (Fig. 3), in the base, which has a capacity equal to four or five stroke volumes. If we suppose the piston C to be at the end of its compression stroke, the clearance space B is filled with mixture, which is ignited by the sparker F. At the same time the chamber A is filled with fresh mixture, which enters by the ports G. As the piston moves out under the force of the explosion, the ports G are covered and the mixture in A is compressed into the base. Near the end of its stroke the piston uncovers the exhaust ports H, releasing the burnt gases; and presently afterward it uncovers the transfer port J, which is in communication with the base. The left-hand cylinder shows the piston at the end of its stroke. The fresh mixture, under moderate pressure, enters through J and passes through the perforated plate K, expelling the remainder of the products of combustion. The return of the piston, closing J and compressing the fresh charge, completes the cycle.

The rock shaft to which the lever D is keyed passes up into the casing above the cylinders and carries at its upper end the horizontal **T** or cross arm L, whose ends are turned to form trunnions, as shown. A sort of ring, M, is pivoted on these trunnions, and at right angles to the latter it carries bearings for the crank pins $N_1$ of the cranks N, by which the reciprocating half turns of the vertical rock shaft are converted into continuous rotary motion.

The governor is beneath the dome-like cover P, and acts by closing an admission valve when the speed is too great. A spring tends to hold the valve normally open, and it is always either wide open or fully closed. The cover R has the main bearing caps integral with it, and the upper part of the mechanism can be dismounted without disturbing the pistons and attached parts. The construction of the pistons in two parts, a trunk, $C_2$, and a head, $C_1$, will be noticed. The motor is said to run from 400 to 1,200 revolutions per minute, according to how the governor is set.

## Controllability of Motor Vehicles.

A correspondent of the Weekly Telegraph writes thus of the showing made by the hill-climbing contestants in the 1,000-mile trial:

Considering the number of vehicles engaged and the extraordinary speeds attained, it is a fine testimony to the skill of the drivers that no accident happened. But greater merit is due to the braking arrangements fitted on the cars. This trial will teach the public that a motor car at 25 miles an hour can be pulled up more rapidly than a horse-drawn vehicle traveling at 10. Hence, much of the danger attributed to motors is but imaginary. The safety of a vehicle is measured by the controlling power which the driver possesses. The motorist has two powerful brakes which are instantly applicable, and at the same moment he can completely shut off the motive power. These operations can be performed in less time than a horse driver draws rein, which in reality is little better than a signal to the horse that a stoppage is required. How soon this is brought about depends on the inclination and temper of the animal, and the method he employs is clumsy and slow. There are no brakes on the wheels of the car as a rule, so that the whole work of checking speed has to be performed by the horse. This is equivalent to fitting brakes on a locomotive only, and expecting it to be able to pull up a long train rapidly.

On Taddington Hill, near Buxton, some remarkable examples of the climbing powers of the motors were evidenced on the up grade; and down hill even more wonderful proofs of controlling power were shown. Though the hill had many dangerous windings and the gradient was very great, at parts the cars were let out at full speed. There was one exceedingly dangerous corner, which was nearly being the scene of several fearful accidents. The bend was less than a right angle, and the road at this point overhangs a precipice, the only protection being a low stone wall.

It was only at the last moment that the motorists, some of whom were traveling at close on 30 miles an hour, recognized the danger of the corner. Then power was instantly shut off and all the brakes clapped on hard.

In one car [C. S. Rolls's], so violent was the check in speed, that everything loose on the car (including a passenger) was flung off. The great car skidded around the corner within a few inches of the wall. Another car, with all brakes on, was unable to get around, so great was the momentum, and it slid right up to the wall, and then stopped, giving the driver a clear view of the precipice he so narrowly escaped from. There were several other hairbreadth escapes, but the chauffeurs only laughed, straightened things on their cars and switched on the speed again.

## An Electric Car's Record Run.

At last the B. G. S. electromobile has broken the spell of bad luck which of late has dogged its footsteps, or rather wheels, and has succeeded in achieving a truly remarkable performance. In the Critérium d'Electricité, a rough pavement taken at rather too fast a speed caused a short circuit, and when a fresh trial was made some few days later a collision with a carrier's cart placed the self-propelled vehicle hors de combat. But on Saturday last these troubles were completely forgotten in the triumph of a record performance, and a veritable record; 262 kilometers, or 164 miles, covered at an average speed of 16 kilometers (10 miles) per hour, on a single charge, is something to be proud of; and this was done on no selected level route, but over the Paris-Dijon road, which is for the first 200 kilometers out of Paris of an average hilly nature, and then becomes a veritable route of mountains, extremely trying for a car which has already traversed a couple of hundred kilometers. The grades of these hills of the Bourgoyne are frequently 11 and 12 per cent.—pretty stiff work for an electric vehicle, especially after a long run. And this is what MM. Garcin and Prade found on Saturday last after arriving at Tonnerre, 200 kilometers from Paris, with a comfortable lead of 82 minutes on their schedule time. The next 18 kilometers took them an hour and a half to cover. the voltage falling from 88 to 84. Even then the hills were far from finished with, for on leaving Ancy-le-Franc excessively steep grades were encountered at Nuits-sur-Ravierès, Fuloy, and finally at Sombernon, where the voyagers were compelled to relinquish their task. Here, exactly 262 kilometers from Paris and 64 from Dijon, this memorable journey was terminated, and M. Kriéger's previous record beaten by no less than 110 kilometers. The car itself is one weighing 2,300 kilogrames, the two batteries accounting for 1,260 kilograms of the total weight. M. Prade, of "Le Velo," who, as above stated, accompanied the car throughout the trial, gives the following interesting particulars concerning it. The two batteries consist of 44 grouped elements, each element weighing 14 kilograms and containing 9 kilograms 600 grams of plate. The batteries' total capacity is 325 ampere hours—that is to say. 33 ampere hours per kilogram of the vehicle's weight. At the normal speed of 22 kilometers per hour on the level, the motor takes 36 amperes at 90 volts. This makes 65 watt hours per kilometric ton at 22 kilometers per hour. The car has eleven combinations, five speeds, two reverse speeds, two electric brakes, and possesses a system of recuperation by means of which, during this record run, an average of 40 amperes was made in the descents. The greatest consumption was 100 amperes at the first speed in ascending the hills of Lézuines and Ancy.—The Motor Car Journal.

## Trouble in Cabourg.

If we may judge by the following story from La France Automobile, the ingenious Gauls have other ways of blocking the wheels of automobile progress than the crude one of speed limits enforced by bicycle police:

Everyone remembers the tree of Cabourg which was felled across the road after an automobile had appeared in that vicinity. That incident of last summer has long passed from notice, but the owner of the tree in question has by no means said his last word. He has resolved on a course involving the utter ruin of Cabourg. But we will describe the matter in detail.

M. Duquesne, then proprietor of the villa "La Divette," objected to the automobiles which passed his place and frightened his horses. No casualty had occurred, but he addressed a petition to the Municipal Council of Cabourg aiming at the prohibition of that road to chauffeurs.

The Deputy Mayor of Cabourg assured the petitioner that he would support his demand with the Touring Club of France, and that it would be favorably received. The T. C. F., however, replied by protesting before the Council, and the prohibition was not granted. *Inde iræ* of M. Duquesne, who thereupon hit upon the tree device, of which La France Automobile published a photograph at the time. The chauffeurs protested loudly, and the local paper called the owner of "La Divette" an assassin. Then, with the end of the season, Cabourg was deserted, and every one thought the affair buried.

By no means! On the eve of the local elections M. Duquesne announced that if the Deputy who had refused to prohibit the automobiles were re-elected he would donate his villa to a scientific body of Paris physicians, with the proviso that it should be converted into a sanatarium for the care of contagious diseases, such as smallpox, ring-worm, scurf, etc. The intent was plain. Who would come back to Cabourg when it was infected with maladies of that sort? Its ruin would be speedy and sure.

The townspeople, however, thinking M. Duquesne's threatened vengeance somewhat disproportioned to the cause of his ill humor, did not credit him with an intention to go to extremes, and the Deputy was re-elected.

Alas! the threat was executed, and "La Divette" passed into the hands of the medicos.

"This is serious," said the electors of Cabourg; and they sought M. Duquesne.

"Yes, it is serious," he replied. "Let the Deputy resign and I will give the doctors another property of mine in Seine-et-Oise in place of this one. If he does not resign, you will get the smallpox, the ring-worm and the scurf."

They returned to the Deputy.

"Give up your commission," said they.

"Oh, no!" he retorted; "I shall keep it. You have elected me, and here I stay."

And thus it stands. The automobile industry is destined to be the cause either of the Deputy's resignation or of wholesale infection in Cabourg!

The rigid prohibitions against road races, now in force in France, were relaxed lately in the interest of three motocycle races organized by "Le Velo" to take place May 10, 17 and 31. The permission accorded to "Le Velo" emphasized the absolute necessity of reducing speed to a walking pace when passing through the villages and hamlets bordering the route; it laid stress upon the importance of each competing vehicle being distinctly numbered and insists upon the organizers of the races assuring themselves that each competitor holds the required certificate of competency.

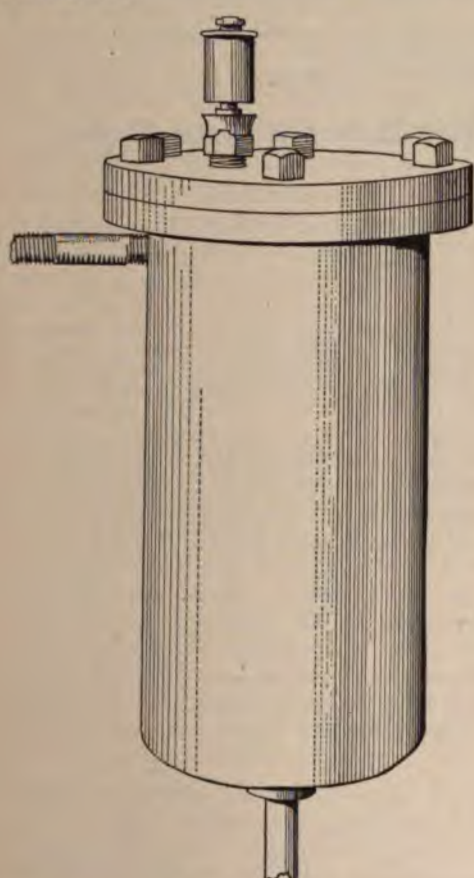
The route was from Etampes to Chartres—50 kilometers—and return, and the race was won by Marcellin in 1 h., 24 m. 58 4-5 s., with Baras and Béconnais second and third respectively. There were 15 starters, and 14 finished, the unlucky competitor being Osmont, one of whose pistons broke when he was 4 kilometers from the finish and lying third. The best previous time was made in 1899 by Teste, who covered the course in 1 h. 56 m. 36 s. The weight limit was 250 kilograms (550 lbs.), and the winner rode a machine weighing 159 kilograms, with a two-cylinder motor. His average time was 71 kilometers (44 miles) per hour.

**The casualties in the 1,000-mile trial totalled one dog, one sheep and one hen killed, and a horse with leg broken.**

## A Low Water Alarm for Vehicles.

We show a cut of the Kitts Low Water Alarm as it appears in its smallest size, for vehicle use. It consists essentially of a drum placed at about the water level and having steam and water connections. Inside the drum is a float connected by levers to a valve at the top of the drum. This valve is normally closed, but when the water level falls below the point of safety the float opens the valve and the escaping steam blows the little whistle seen on the head of the drum. The makers claim that with this alarm the carriage could safely be run even without a water glass.

The alarm is made of brass, weighing 8¾ lbs. complete, and is tested under 300 lbs. water pressure. The Kitts Mfg. Co. make other styles of alarms for both low and high water for boilers of any size.





# MACHINERY and TOOLS for motor vehicle builders

## The Ferracute Drawing Press.

The machine illustrated in the photograph below is one of the latest improved non-geared, double-action drawing presses made by the Ferracute Machine Co., it being the fourth size of a series of six sizes of this design, and six others with gearing, the geared machines being used for deeper and heavier work than the non-geared.

This machine is equipped with a hardened steel automatic stop clutch, treadle lock, long slide bearings and various other improvements. Among these is an adjustable bolster for getting a uniform pressure around a large blank, which is being drawn by the double-action process into a cuplike form. Objects of this kind are largely used in bicycle and automobile factories, where there is a constantly growing demand for a variety of articles drawn from cold sheet steel. Nearly all the fittings forming the joints of tubing in cycle work are nowadays made in presses, as are various operations on hubs, roller bearings, etc.*

## Automobile Supplies for the Trade.

The Automobile Supply Co., of St. Louis, believes that the time has come when the more important parts of the running, transmission and steering gears of motor carriages can be conformed, for different classes of service, to recognized standards. Accordingly it has undertaken, after a careful review of the field and an investigation into the requirements of the different classes of vehicles, to handle an extensive line of these parts, some of which they manufacture themselves, and others of which are the product of leading makers in those special lines. These include solid and pneumatic tires, wood and wire wheels, ball and roller bearing hubs for axles of various sizes; front and rear axles and steering hubs; reaches, springs and frames complete; sprockets, chains and differentials; steering gears, etc. These are sold either separately or made up ready to receive the motor and body, and can be made of any desired wheel base and gauge to suit requirements. The company handles also batteries, coils, igniter dynamos, pumps, etc., of standard makes. The accompanying illustrations show some representative parts.

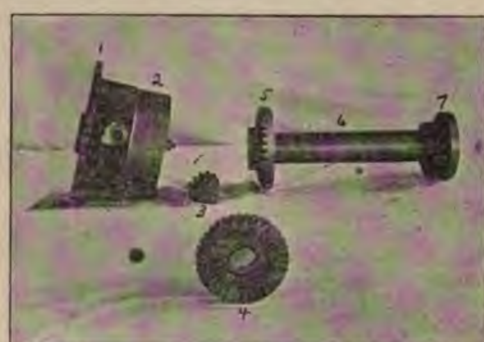


FIG. I. DIFFERENTIAL, ETC.

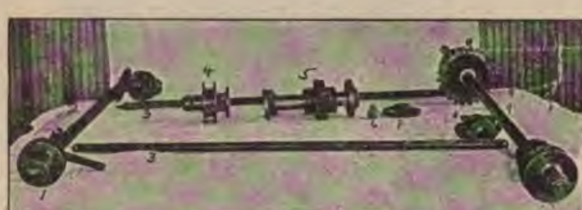


FIG. 2. RUNNING GEAR.

FIG. 3. LIGHT RUNNING GEAR.

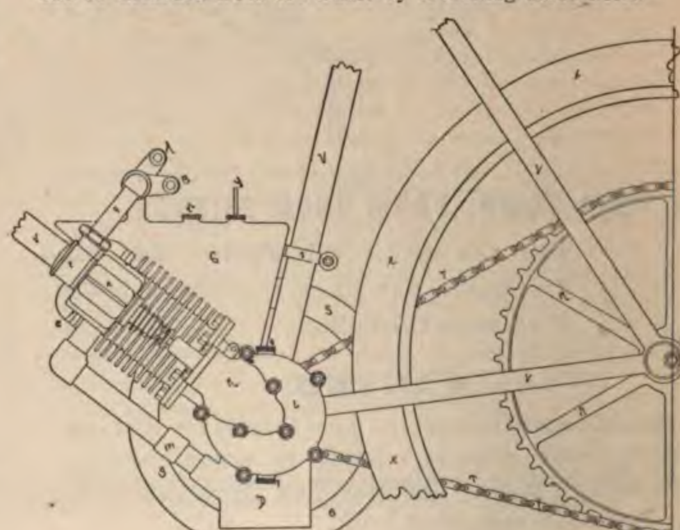
FIG. 4. ELECTRIC RUNNING GEAR.

## The Holley Bicycle Motor.

Our illustration shows a new bicycle motor made by George M. Holley, Bradford, Pa., which is said to develop 1¾ h.p. and to be capable of pulling a 150-lb. rider up a 15 per cent. grade.

Referring to the drawing, it will be seen that the motor is attached to the frame so that the motor shaft passes through the crank hanger. l is the crank case, k the cover over the cam and 2 to 1 gears, C is the carbureter, with filling plug n and air vent y, and G is the supply pipe to the inlet valve, with throttle lever A and mixture regulating lever B. H is the exhaust valve box, and the igniter plug screws in at e. D is the muffler, and the exhaust pipe is tapped at m to supply heat to the carbureter. S is the fly-wheel, which balances the weight of the motor, and the rear sprocket R has either 36 or 48 teeth, according to the roads. The cap o on top of the crank case is used both for introducing oil and for preventing compression in the crank case.

The wheel is started by pushing it along with relief cock open, till the motor picks up the cycle. Speed is regulated by shifting the ignition and by varying the mixture. The motor can be detached from the frame by loosening three bolts.



## MINOR MENTION.

An automobile mail collector is being tested in Concord, N. H.

George A. Kessler & Co., 20 Beaver St., New York, have put an electric truck into service.

The Woods Motor Vehicle Co., of Buffalo, has been incorporated with a capital of $300,000.

It is the intention to substitute motor vehicle races for bicycle races at the next Interstate Fair in Trenton, N. J.

The Pacific Automobile Co. has been incorporated to do business in Los Angeles, Cal. Its capital is $100,000, of which $23,000 has been subscribed.

The American Carriage, Car & Motor Mfg. Co., Charlestown, W. Va., has been incorporated to make and deal in vehicles of all kinds. Capital, $5,000,000.

The Little & Congdon Co., Amesbury, Mass., has been organized for the purpose of manufacturing and dealing in carriages, automobiles, etc. Capital, $100,000.

The electric vehicle companies of Chicago have fitted out three "auto hospitals" on wheels, which may be summoned to any part of the city to care for breakdown cases.

Elmer A. Sperry, of Cleveland, read a paper on "Automobiles as a Source of Revenue to Central Stations" before the recent meeting of the National Electric Light Association in Chicago.

According to Henry L. Budd, State Road Commissioner of New Jersey, the farmers in that State are awakening to the value of good roads, and petitions for road improvements are coming from them daily.

The Adams Express Co., of Chicago, contemplates the use of steam vehicles to handle its down town traffic, and Arthur Herschmann, the company's engineer, is making tests with a steam truck designed for this work.

The Lowell Model Co. have sent us a pamphlet illustrating and describing their small air and water cooled motors for vehicles and boats. They supply the unfinished castings for these motors, and handle accessories as well.

The North Side Improvement Co., Wilmington, Del., will run an automobile line between Sixth and King Sts. and the Boulevard and Concord Turnpike. Four vehicles, each seating 16 passengers, have been ordered. The fare will be 5 cents.

The Maltby Automobile Co., 10 Clinton St., Brooklyn, has sent us their catalogue, showing two styles and several sizes of small motors for launches and vehicles. They are at work on another style of motor, in which they promise to show some novelties.

A movement is on foot to test the new rule of the Baltimore Park Board admitting only electric carriages to the parks of that city. Henry T. McKnight, of New York, acting for the Locomobile Co. of America, was refused admittance lately to Druid Hill Park, and will begin test proceedings against the Board.

The Oxford Automobile Co., 53 State St., Boston, send us their circular. They are preparing to build steam carriages under the patents of Milne & Killam, of Everett, Mass. The engines of these vehicles are illustrated by outside views, and are seen to be four-cylinder and single-acting, with the cranks inclosed.

A toll taker in Schenectady, N. Y., when called upon to collect toll for the first automobile that went through the gate, settled the question of rates by the horse-power of the vehicle, "10 cents for a team and 5 cents for each additional horse," or 15 cents, on the rider's statement that his was a 3-h.p. machine.

The Construction Liègeoise d'Automobiles, Liège, Belgium, send us a pamphlet describing the "Voiture Duryea," for which they hold the Belgian patents. The characteristic American features of these carriages and their merits as compared with Continental practice are well set forth, especial mention being made of the low vibration, the details of transmission and the interchangeability of parts.

The reorganization committee of the General Electric Automobile Co., comprising G. M. Dodge, New York; George Tracy Rogers, J. S. Arndt, J. M. Butler and Thomas Earle White, is about to issue a circular calling for an assessment of $4 a share on the 50,000 shares of capital stock, payable in two installments of $2 each. The company owes $50,000, so that if all the shareholders pay up there will be $150,000 left for working capital.

## The Werner Motocyclette in This Country.

Banker Bros., Highland and Centre Aves., Pittsburg, Pa., announce that they have taken the sole United States rights for the Werner motor bicycle, which was described in The Horseless Age of May 23. They intend to make a specialty of supplying the separate motor with attachments, such as battery, igniter plug, induction coil, wires, driving belt, drive rim and special front forks and handle bar—in other words, the parts shown separately in the accompanying photograph. Any manufacturer or repair man can thus build his own motor bicycle with these parts very easily. All that will be required will be a front wheel, rear wheel fitted with coaster brake, and the frame. In addition to the motocyclette parts, they will carry a complete line of the usual accessories and fittings, valves, etc., for Werner and other motors.

# MOTOR VEHICLE PATENTS of the world

## UNITED STATES PATENTS.

649,899—Compensating Gear.—H. M. Brenenstul, of Wakeman, and A. M. Carpenter, of Cleveland, O. May 22, 1900. Application filed Dec. 20, 1899.

A pair of roller grip clutches in the hubs of the drive wheels, which permit the outer wheel, when the vehicle negotiates a curve, to run ahead, while the inner wheel does the driving.

Four claims.

650,014—Electric Motocycle.—Isidor Kitsee, of Philadelphia, Pa. May 22, 1900. Application filed July 3, 1899.

A primary battery whose negative element is in the form of vertical disks on a horizontal axle, by which the disks are rotated with their lower portion immersed in the exciting liquid. Stationary brushes bear against the surface of the disks to remove the hydrogen bubbles set free thereon by the electric action, said brushes forming in effect a mechanical depolarizer.

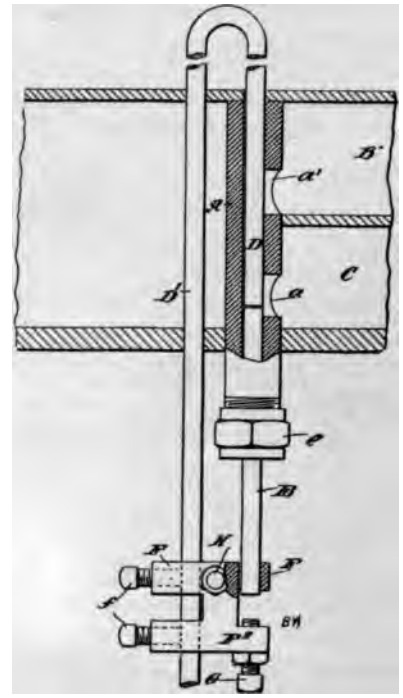
Eight claims.

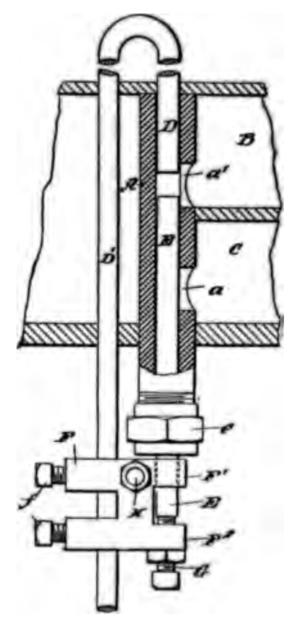
650,266—Feed for Explosion Engines.—W. J. McDuff, of Tilton, N. H. May 22, 1900. Application filed Oct. 5, 1899.

The purpose of this invention is to insure a uniform and accurately measured feed of hydrocarbon—so much per stroke—to the air supply of an explosion engine, and to accomplish this without the use of valves.

In the figures, C is a passage containing the hydrocarbon and B is a passage leading either to a carbureting device or directly to the cylinder of the engine. The two ports a and a' align lengthwise of the cylinder A. D is a plunger, which may if desired pass through a stuffing box at the upper end of the cylinder A, and which is bent back upon itself and carried down to a block or crosshead F, to which it is secured by set screws or other suitable means. Through the bottom of A passes another plunger E, which runs freely in a hole in the ear F' of the crosshead F. A set screw or stop, G, is provided to regulate the movement of the plunger E between the plunger end of D and the screw G, and the crosshead F is made to reciprocate vertically by suitable connection with a cam or eccentric, having one such reciprocation for each power stroke.

The operation of the device is as follows: In the position shown in Fig. 2 the abutting ends of the two plungers lie within the port a, which communicates with the oil supply. When the crosshead F is moved upwardly, the plunger D moves promptly therewith, as it is fixedly secured to the crosshead, while the plunger E does not start to move until it is engaged by the set screw G. In consequence of this the inner ends of the two plungers are separated, and when the plunger E is carried along an amount of oil is carried with it equal to the space between the ends of plungers. The movement of the plungers within the cylinder is sufficient to carry the abutting ends of the plungers from one port to the other. The other limit of the stroke of the plungers is shown in Fig. 3. Upon the return stroke of the crosshead the plunger D moves off promptly, while the plunger E is





held against moving until it is engaged by the end of the plunger D. This forces the oil between the two plungers out into the chamber B, which is in communication with a carbureting device or with the cylinder of the engine. The amount of oil delivered is controlled by adjusting the slack between the two plungers by means of the set screw G. This may be readily done while the engine is in motion, as the stroke of the plunger is comparatively slight.

Four claims.

650,315—Vehicle Axle Nut.—H. R. Hamer, of North Adams, Mass. May 22, 1900. Application filed Dec. 18, 1899.

Three claims.

650,316—Vehicle Axle Nut.—H. R. Hamer, of North Adams, Mass. May 22, 1900. Application filed Jan. 20, 1900.

Two claims.

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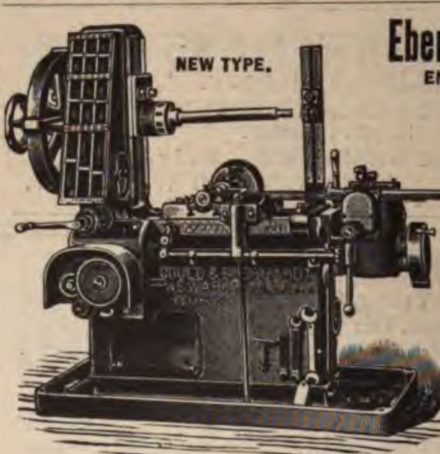


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### Volume I, No. 1.

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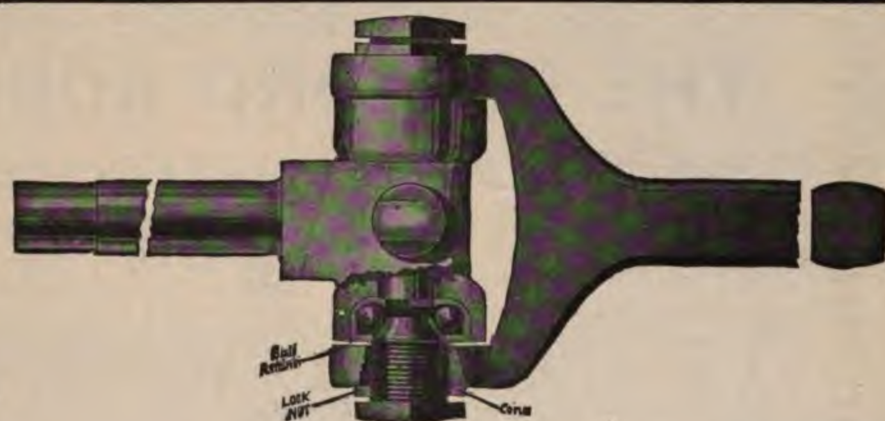

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BY ISAIAH L. ROBERTS.

OTHER INFORMATION ON THIS SUBJECT BY WELL-KNOWN EXPERTS CONTAINED IN OUR

## STORAGE BATTERY NUMBER. Issue of September 27th.

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# THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. VI. NEW YORK, JUNE 13, 1900. No. 11.

## THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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HERBERT LADD TOWLE, Associate Editor.

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COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

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## The Acetylene Motor Number.

The following are the titles of some of the articles that will appear in the Acetylene Motor Number, June 20: "Acetylene and Alcohol versus Gasoline as Fuels," by Isaiah L. Roberts; "Will Acetylene be the Coming Power for Motor Vehicles?" by D. N. Long; "Acetylene and Its Adaptability as a Motive Power for Vehicles," by E. C. Oliver; "Acetylene Generators for Motor Vehicles," by W. F. Cooper.

## Concerning "Bugs."

The assertion of our correspondent, "E. T. B.," in last week's Horseless Age, to the effect that no mechanism within the range of his experience was so given to developing new varieties of "bugs" as gas and gasoline engines, does not greatly malign these interesting machines. We fancy that most of our readers will have little difficulty in agreeing with "E. T. B.'s" opinion; and if their experience has been with perfected engines and not an experimental one, they will probably concur likewise in the opinion that the smallest part of the "bug" difficulty is to eradicate the insect when found. The best gas engines, especially in large sizes, are remarkably free from aberrations of this sort, and as they are under the constant care and inspection of regular attendants, it is seldom that their ailments prove seriously perplexing. Moreover, they have one advantage over gasoline engines in that they are rid of the vaporizing problem; and as the gas which they use is more nearly equal in density to the air with which it is mingled than is gasoline vapor, its complete diffusion is distinctly a simpler matter.

The small gasoline engine, however, has its share of "bugs," and these are not made fewer when it is put on wheels and sent out on the road. If the engine is well designed, it usually needs only a little intelligent care to locate them, and the correction of the fault is ordinarily a small matter. "E. T. B.'s" experience was a rather exceptional one, although plenty of wires have broken and will continue to break without flying asunder, the insulation or external pressure retaining the broken ends in proximity and occasional contact. It is to be noted that this particular difficulty is not, strictly speaking, chargeable to the engine itself, and it might happen as easily with one engine as with another. One very common aberration in small gasoline engines, and one which is not external to the engine, is not mentioned at all in the article of Mr. Cooper. We refer to the excessive prolongation of combustion. The article referred to really dealt mainly with the conditions requisite to produce ignition with something approaching to full power; and as it was addressed chiefly to the users of launch engines, in which 10 per cent. more or less in the power makes very little difference in the speed of the boat, the omission of the (in that case) superfluous refinement was not unreasonable.

Nevertheless, too slow combustion is quite as bad, from the view-point of economy, as too rapid combustion and it contains possibilities of trouble in the running of the engine which do not appear in the other case. A very common nuisance with small engines, and especially with two-cycle engines, is

"back firing." As has been pointed out by our contributors, this may often be caused by improper seating of the inlet valve; and, however caused, the preventive usually applied in four-cycle vehicle motors is the wire gauze. This, however, is hardly practicable in two-cycle motors, which are peculiarly subject to the fault; and we believe that a search for the root of the difficulty will usually disclose that it is due to the fact that the combustion is not completed when the inlet port is uncovered, and that in consequence the fresh entering charge takes fire from the old one. In this case, naturally, to cure the disease is better than providing any quantity of gauze plates to arrest the symptoms; and this can be done either by advancing the ignition or by securing a more perfect mixture.

The Editor recalls a little 3 x 4 in. two-cycle engine, the first one built of its particular make, which gave its inventor an enormous amount of trouble in the first few weeks after it was put together, by "back firing" about every other minute when run with gasoline. If the brake (a board under the fly-wheel) was promptly released, enough fresh air was drawn into the crank case, before the motor stopped entirely, to enable it to pick up again; but it could not have been trusted to run a popcorn shaker if left alone. This same engine worked perfectly with gas, and after all hands had scratched their heads over the conundrum for some time, and after (apparently) every conceivable expedient had been tried without success, some one began watching the exhaust end of the motor. It was then noticed that when gasoline was burned a blue flash was visible inside the cylinder at the instant when the exhaust port was uncovered by the piston, while when gas was used no such flame appeared. The inference was obvious. The carbureting device (subsequently perfected) was then exceedingly crude, and the mixture was therefore irregular, probably too rich, and far from homogeneous. As the development of a perfect vaporizer is not the work of a day or two, and as a short cut was necessary, the ignition was slightly advanced. The change amounted to less than 4 deg. on the crank circle, but it was enough for the purpose, and the engine never "exploded back" again.

The familiar liability of two-cycle motors to "explode back" when throttled and running light is doubtless due to the same cause, as a mixture largely diluted with burnt gas will burn much more slowly than a pure one; but it may be due also to variation in the proportions of vapor and air, if the vaporizer be poorly designed.

A more occult "manifestation" which once came to the Editor's notice was that of a 6 x 12 in. stationary engine. This engine had an overflow cup mounted on the cylinder head, adjacent to the inlet valve, and the gasoline was introduced to the air stream by gravity instead of by suction, the gasoline orifice being pierced in the seat of a small conical valve which was opened by the same cam that opened the inlet valve. The gasoline therefore entered the air stream only a couple of inches before the inlet valve was passed, but nevertheless "back firing," though not extensive enough to do damage, was annoyingly frequent. Time passed, experiments were made, and the back firing was stopped. The engine was sold, and the inventor was asked how he did it.

"Jammed a piece of wood in the air suction pipe," he replied. "It stopped it dead."

No explanation was offered of the seemingly inconsequent result of this simple manœuvre, and the Editor confessed himself mystified. After much reflection, however, it occurred to him that, as the effect of the obstruction would be to increase the vacuum in the pipe, the needle valve controlling the gasoline orifice would need to be partly closed to offset the greater suction, and the gasoline would flow in a smaller and sharper stream, which would mingle it more thoroughly with the air and lead to more rapid combustion. As the air passage was not so formed as to give the air any extra velocity at that point, it seems quite reasonable to suppose that before the change the gasoline had trickled instead of spraying into the air; and with an irregular mixture and not too early ignition, some flame might easily have lingered, out of reach of the exhaust valve (which, like the inlet valve, was in the cylinder head), long enough to ignite the fresh mixture.

## The Gordon-Bennett Cup Race.

The date of the Gordon-Bennett race (June 14) is announced as definitely settled, and unless something wholly unforeseen occurs it will have been run off before this issue of The Horseless Age reaches most of its readers. The course is about 350 miles, being as follows: Paris, Etampes, Pithiviers, Montargis, Nevers, Moulins, La Palisse, Roanne, Villefranche and Lyons. It is probable that the start will take place from Versailles, and excellent roads will be encountered throughout the route, although the level nature of the course gives way to a hilly, if not mountainous, route after Roanne is passed.

May the best machine win!

## De Dion Motors at Waltham.

We show opposite a photograph of the tandem ridden by Henshaw and Hedstrom and fitted with a De Dion motor. It is declared by them to be the fastest motor vehicle in the world. At Waltham, Mass., in the Memorial Day races, these motors were fitted to the winning tandem of every event run, including the 5-mile motor race, which was won in the time of 7 m. 36 s., with the nearest competitor half a mile behind.

Gasoline vehicles have been introduced in Algeria and the Soudan, and La France Automobile has lately published an extended series of articles describing them, with numerous photographs showing these vehicles on desert sands, in Oriental streets and under the novel shade of palms.

## The Automobile Wagon for Heavy Duty.*

By Arthur Herschmann.

Taking up the different propelling agencies which have been experimented with so far, we find that almost every known motive power has been tried. Steam was employed as early as 1820, and such wagons were built by the world-renowned Ericsson and Tangyes in England, and even James Watt is said to have constructed a steam carriage. With the low steam pressures then available, poor roads, and difficulties with unreliable material and workmanship, it is not surprising that the matter was allowed to drop. The next experiments were in the line of oil engines, followed by electric vehicles, compressed air, carbonic acid and the revived steam carriage.

Naturally, in this country, leading the world in electrical subjects, expectations were greatest with electric vehicles. The electric equipment renders a vehicle clean and easy to operate. These vehicles can be made to answer the requirements of running on smooth city roads. The suitable commutation of battery cells provided in these vehicles, effected through interconnection of contacts on the "controller," affords, together with the series and multiple arrangement of the motor, some flexibility in the power and speed conditions of the machine. There are, however, inherent disadvantages to the use of batteries, which grow prohibitive in a motor wagon intended to carry heavy weights over a long distance. It is common experience that on rough roads the punishment is more than the batteries can stand, and where we have a case of heavy loads to be carried, necessitating the use of steel tires, we can well say that at this phase of the evolution the battery makes the electric truck an impossibility. It would lead too far to enter minutely into the matter of cost of operating electric wagons, but it may be stated that the best traction cell has only a capacity of about 7 watts per pound of its weight, and with this as a basis one can soon calculate how much dead weight a wagon would have to carry to propel a big load over a long distance with one charge. The "maintenance" of batteries, apart from the actual cost of charging, is seldom spoken of, though it is perhaps the most serious item.

Next to the electric wagon we saw the auto-truck, or, better still, heard about it. It was stated that compressed air trucks would soon be operated in considerable numbers. Now, while it cannot be denied that compressed air would make an ideal motive power, we have still to look for a complete revolution in the construction of light storage tanks to render this power available for trucks, granting that other disadvantages inherent in the use of compressed air can be practically overcome. Weight for weight, stored electricity lends itself more readily to the propulsion of wagons, since it will, as it were, "keep pressure" until it becomes well nigh exhausted, while the air pressure falls gradually as the air is drawn from the storage tanks. The tank weight per cubic foot of air is about 85 lbs.; the air itself weighs 11 lbs., and at 2,000 lbs. per square inch, represents 0.27 h.p. hour. To heat the air, considerable weight has to be carried.

Carbonic acid has also been proposed for the operation of wagons, but it suffers in common with compressed air, and, moreover, the raw material to be compressed is by no means cheap.

It has been proposed to compress illuminating gas and use it for the propulsion of gas motor wagons. While the radius of the operating district for such a vehicle would be evidently greater than with the other storage systems, seeing that about 18 cu. ft. of gas at normal pressure would already give 1 b.h.p., while about as many cubic feet of air of 200 lbs. pressure or of carbonic acid of a high pressure are required. This system has, however, the disadvantage of seriously complicating the mechanism.

* Extracts from a paper read before the American Society of Mechanical Engineers, Cincinnati, May, 1900.


HENSHAW & HEDSTROM'S PACING MACHINE.

A great deal of experience has been gained with oil motor wagons, though chiefly in the line of light pleasure vehicles; and France, in which country there are many thousands of these vehicles plying, has led the world in their exploitation.

As regards freight vehicles, however, no important results have been obtained with the use of explosive motors. A motor wagon, on account of its great weight and peculiarity of operation, must have an abundant supply of power; so great, in fact, as to puzzle the uninitiated observer. We find that a load which can be easily negotiated by one horse, calls for a power equipment equal to about 14 h.p. on the part of a motor wagon. While we commonly understand that 1 h.p. equals 33,000 foot-pounds per minute, we should consider how great the work of a horse can be for a short while on the race track, or when he becomes infuriated, and with "blind staggers" dashes into destruction. A horse, when required to pull a heavy load out of a difficult position, will not only jerk and lift the shaft so as to bring the wheels out of a rut and get them on a level, but will momentarily exert power which has been, by means of a dynamometer, shown to be adequate to a performance of what we commonly call 14 h.p. Some people, in fact, assert that the horse can for an instant by far exceed the latter figure, but we may be well contented to accept this as a basis of calculation for the supply of motive power. The same horse having pulled his wagon out of the difficult position, is able to modify the output of his energy, propelling the wagon at a good rate of speed as soon as he reaches better ground. The "speed-changing device," which should as nearly as possible emulate the peculiarity of the horse's muscular system, is still the greatest problem with designers of oil wagons. The most ingenious devices have been already tried with a view of filling this gap, and with more or less success; they consist chiefly of such elements as spur and bevel gears, belts, chains, shifting wheels, expanding pulleys or combinations of some of the above devices with brakes and clutches. Even hydraulic and electric combinations have been unsuccessfully tried. An oil engine to run a motor wagon cannot well be designed to vary in speed, at least not in a wide range, and be satisfactory in other respects. Its construction necessitates its running at a constant speed, while the speed requirements of the wagon wheels, to which it is geared up, are ever changing. Clutch and shifting gear wheels are, therefore, essential parts of every oil motor wagon, and their operation, on account of the impact of the moving masses, often gives rise to serious trouble. Non-reversible, an oil engine is by no means a flexible motor. It will not start under load, and when it is in running condition it is very dependent on an even influx of its explosive mixture, and is liable to come to a dead stop without warning when its capacity has been suddenly overtaxed. Anybody who may have gotten stuck with a motor vehicle while ascending an incline will appreciate these remarks. In such a case it will occur to him that it is very difficult at the same time to release the brake and start the wagon "ahead" on slow speed. It need hardly be said that an oil vehicle is dependent on the weather, inasmuch as the action of the carbureter is influenced by the atmosphere. This latter idea leads to the subject of perfect or imperfect combustion and its attendant outward sign, which is an evil-smelling exhaust. The good behavior of large oil engines on heavy trucks after an extended period of running has not yet been satisfactorily proven, and the deterioration due to the pounding on the frame is a serious drawback. The general use and handling of large quantities of gasoline at this stage of evolution of the oil engine is by no means free from risk of explosion, and there is some danger of affecting perishable goods and foodstuffs by the odor, which would naturally permeate them, particularly while standing at the express company's depot.†

Having thus described the difficulties with which the electric and oil wagons have to contend, we may devote ourselves to the steam wagon, with which, undoubtedly, important results have already been obtained. Before entering into the technical details of the steam wagon, it would be well to consider the problem from an economic and managerial point of view, since it seems that with the best constructed motor wagons, propelled by any power, the technical aspects are still subservient to the commercial. We have found the steam wagon superior to its competitors for the following reasons:

1. It has the greatest load and mileage capacity, or, in other words, radius of action.

2. Its operation is independent of charging stations, and supplies, necessary for the operation of the wagon, can be easily procured and taken aboard quickly.

The operating expenses in the case of an electric (or, in fact, of any power storage system) vehicle grow to be prohibitive as soon as a certain ton mileage capacity is exceeded, tending to keep such an electric wagon small in size.

In the case of an oil wagon such economic restrictions to the size do not exist, and the objections to an oil wagon of large capacity are more by virtue of difficulties in operation.

With steam the case is altogether different. The tendency is here to build a large wagon, since with a steam wagon the weight of the machinery to be carried does not grow even in an arithmetical ratio to the carrying capacity. One advantage found in the operation of a large steam wagon may not be apparent to the casual observer. In the case of the horse-drawn wagon one has to discriminate in loading it with goods which are to be delivered only on the exact route covered by the wagon, seeing that the daily carrying capacity of a horse is limited, while in the case of a large steam wagon this would be less important, since, as will be shown later, the percentage of operating expense due to the actual cost of propulsion proper is infinitely smaller than in the case of traction with animal power.

When I submitted my first report to the Adams Express Co., to whom I stand in the relation of mechanical engineer, in 1898, on the progress made on motor wagons, it was my opinion that there had been, up to that date, nothing constructed likely to form a suitable substitute for a horse-drawn wagon but a steam propelled vehicle. President L. C. Weir then remarked that there seemed to be less difficulty in constructing such a wagon to do the work of two horses than to construct a successful substitute for a one-horse wagon, and I believe that the data which I intend to give later on will convince you of the correctness of this opinion.

As regards the construction of steam propelled wagons, we find that in spite of the fact that steam equipment has been known for many generations, and wagon building has been going on for thousands of years, comparative success has only been obtained within the last few years. Scotte, Serpollet and De Dion, in France, were the first to revive the movement, but in the last few years more progress was made in England, in which country the best steam wagons, so far, have been produced. Easy riding wagons have been constructed for many

† If it were possible to make a practical success of an oil motor wagon, using crude oil, no doubt the scope of the oil motor wagon for heavy duty would be considerably increased.—A. H.

years, and boilers, steam connections and engines do not give much trouble on rock bottom foundations, but when we attempt to locate engine and boiler on a wagon, which latter they have to drive without suffering from the shock of the locomotion on rough roads, new complications arise which are infinitely more important and troublesome than most people believe who have devoted themselves to the study of this subject. We find early attempts to effect this compromise in a steam vehicle built by the Ericssons in England in 1830, who placed a vertical engine on the rear of their vehicle, and coupled it up with a long, springy connecting rod to the front wheels, which acted as drivers, thereby preventing excessive shock being transmitted from the wheels to the engine.

Wheels in themselves are far more important problems than is generally believed. My opinion is that at the present day no form of rubber tire will give satisfaction on a commercial wagon intended to carry a net load of, say, one ton or more. The rubber tire is not only expensive, but gives poor satisfaction under the combined action of great weight and speed. Attempts have been made to retain the desirable features of a rubber tire, protecting the latter with a tire shield of steel, dating back as far as the early seventies, but it would seem that such combinations are just as troublesome to maintain. Steel tires, if properly applied to stiff wooden wheels, have been proven to stand most severe work, and they afford the advantage of strengthening the wheels very considerably. It is my opinion that well-constructed springs of ample proportions are alone the means to lessen the shock to which a wagon wheel is subjected. In the case of dished or cored wheels, which I consider to be best adapted for heavy work, a steel tire is indispensable, since it binds the wheel together and prevents the spokes from being torn out when striking an outer obstruction. There is considerable divergence of opinion as to whether a comparatively narrow tire or a wide tire should be used, whether the wheels should be small or large and whether the front or hind wheels should be driven or steered. While it is a fact, even in the case of motor propelled vehicles, that the width of the tires should be smaller on hard roads and greater on soft roads (but not on sandy roads or in snow), I think that in the case of steam wagons the total width of the tires in inches should be at least twice the number of gross tons carried when small wagons are concerned, say of a capacity of two tons of net load; this coefficient of two to decrease in the case of very heavy wagons to one, and even under.

The reasons why small driving wheels seem to be exclusively used on motor wagons are mostly that it is difficult to design large wheels which will stand such severe strains as motor wagon wheels are subjected to. In this case the spokes of the wheel not only support the load, as in a horse-drawn vehicle, but they are more or less affected by the action of the driving power, and, moreover, there is also a tendency to twist them. With the ideal wagon wheel the power should be applied directly where the wheel touches the ground. In reality we drive onto a spur wheel, or chain wheel, concentric with the wheel, but, of course, of a smaller diameter, and such an arrangement makes it desirable that the wheel should also be small. Another reason making small wheels desirable lies in the requirements of the wagon, and the working of a high speed motor. In other respects it seems to me that a large driving wheel, say of 4-ft. diameter, will answer much better than a 3-ft. wheel, such as has been almost exclusively applied to steam wagons. I consider that not only will a 4-ft. allow of a more powerful starting torque, but it will also save the driving gear, seeing that it does not sink in as deep as a small wheel when it passes over a depression in the road.

The argument presented by advocates of the "front driving" system is that the wagon will steer a straighter course when the wheel strikes an obstruction, for the reason that the front wheels, in striking, tend to run over the obstruction, instead of being forced aside. I have seen such wagons steered behind and in front, and my opinion is that any advantage of front driving is more than outbalanced by the disadvantages introduced in connection with awkward location of the machinery. One of the early steam wagons was driven by all four wheels, and if such driving could be practically effected I think it would prove an excellent feature of a wagon. There are, roughly speaking, two steering systems used—steering with a fifth wheel, and steering with pivoted axle ends. It would seem that the fifth wheel steering arrangement is more adapted for heavy work, leaving the wagon axle unbroken. In reality, this system cannot be as satisfactorily applied as steering with pivoted axle ends. To effect the steering of heavy wagons, spur gearing of suitable purchase has to be used, or a worm and worm wheel device. The latter seems to answer in one of the best designed wagons, but I do not consider it as desirable as steering by means of spur gearing, since it locks the gear, and besides, causes a severer strain on the wagon in case the front wheels strike an obstruction. In rounding a curve, the inner wheels necessarily describe a smaller circle than the outer wheels. To make this practicable, the steering device has to be correctly designed, and the two driving wheels have either to be driven by independent motors or have to be linked together by means of a compensating gear, or, as it is often called, "Jack-in-the-box." It will be found that in a heavy wagon, particularly one using dished wheels, this driving and the arrangement of the compensating gear are rather troublesome, and that there is still great scope for improvement in this connection. The transmission, forming the link between the rear wheels and the engine, which is almost invariably in front of the driving wheels, I think can only be reliably effected by means of accurate spur wheels, immersed in an oil bath. With a steam wagon it is not necessary to use any kind of a clutch while running, seeing that the steam engine is a very flexible prime mover. Nevertheless, I think that a speed reduction gear, which can be best provided by means of two sets of spur wheels of varying diameter, one set stationary, the other movable axially on a square shaft, forms a desirable adjunct to the mechanism, to be shifted when the wagon is at rest, so as to increase its traction power and enable it to negotiate any special hill, or extricate the wagon from a bad position. We cannot deny that for many years to come, greasy and hilly roads, or deep snow, will be the greatest difficulties to contend with. I attempted on a damp day to take a load of four tons up an incline of about 1 to 20, covered with Belgian blocks, and there was trouble with the drivers slipping. The engine was geared 1 to 14, and the wheels were of 3-ft. diameter; in my opinion large and heavier driving wheels and a much lower gear would have taken the wagon up. With the slightest turn of the valve, the engine, without difficulty, started, and on account of the poor adhesion and the light machinery, ran away before the inertia of the heavy wagon was overcome.

The next question we have to consider is the boiler and engine, machinery with which you are all thoroughly familiar. Among the steam wagons built so far, one can notice a great variety of boiler designs. The desiderata of a suitable boiler for a motor wagon are that it should be of the greatest safety,

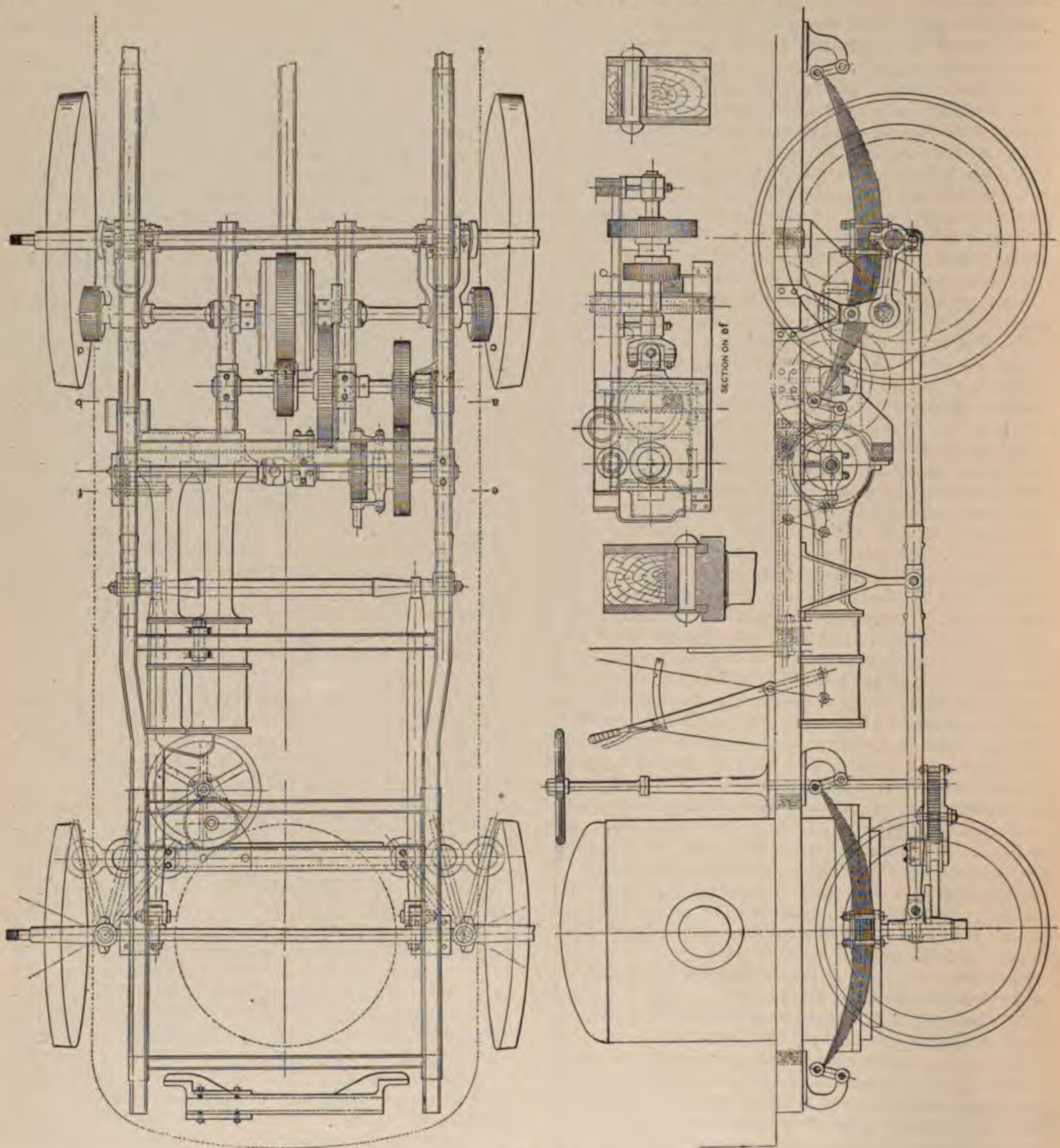



FIG. 1.

of small proportion, quick steaming and economical. In addition, it should be of the simplest possible construction, and free from joints likely to work loose by jarring on the road. Pipe boilers, while perhaps a little safer than shell boilers, carrying little water, are, for the same reason, undesirable for the varying demands made of a wagon boiler. There are other objections to small caliber pipes; they are necessarily exposed to intense heat and liable to burn, and without a large dry tank they will make wet steam. A shell boiler, on the other hand, can be made of ample proportions, and, if well constructed, and watched during its use, should give no apprehensions as to its safety. The water level can be more evenly maintained, and this is a point of some importance. I consider a superheating device an all-round advantage, provided it is correctly applied to the boiler.‡

In addition to the engine feed pump, there should always

‡Fig. 4 shows a water tube boiler designed by the author.

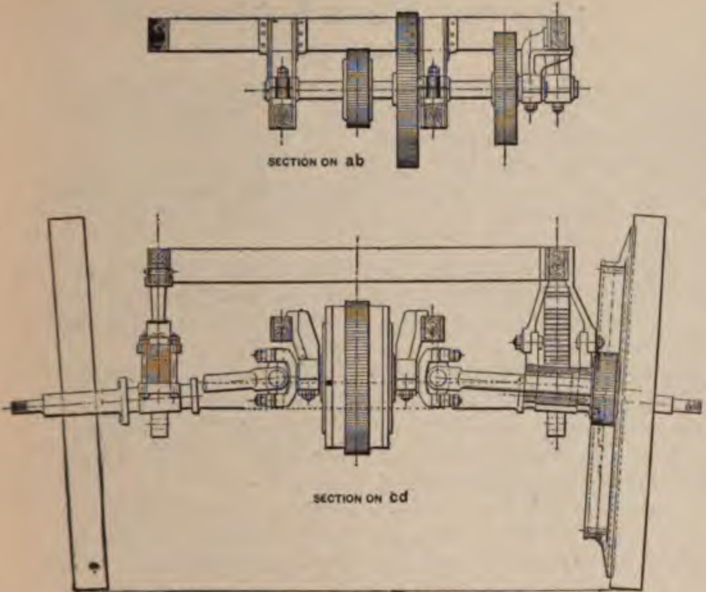



FIG. 2.

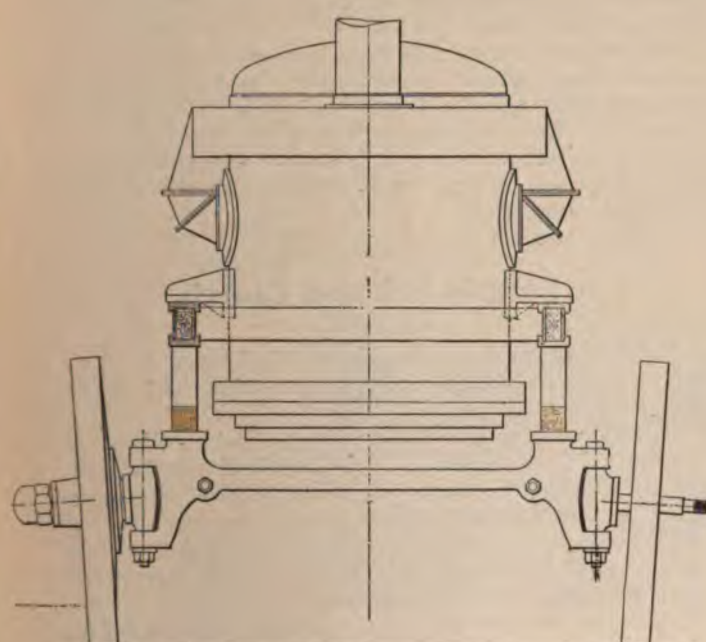


FIG. 3.

be a second steam-driven pump instead of an injector, which latter, when of small proportions, has not yet been made to give satisfaction on a wagon.

The firing of a wagon boiler can be most easily effected by means of an oil burner, and with a steam governed burner the firing will automatically respond to the requirements. However, in addition to the inherent disadvantages of using oil, it is difficult to maintain the burner in good trim during all kinds of weather, and at this stage of perfection oil burners will "roar" and occasionally give trouble and make smoke. For the latter reasons coal and coke are preferable, being besides cheaper in use. Solid fuel can be conveniently stowed away, around the boiler, which latter is generally fixed in front of the wagon, and if thus located the stored fuel acts as a compressible safeguard to the boiler in case of a head collision. In using a shell boiler it is found convenient to fire through the boiler top, a system originally introduced into steam wagon practice with the De Dion boiler.

The difficulties with which one has to contend in the use of steam wagons are that they will occasionally show a little steam, and during a sharp frost it will be found difficult to prevent a pipe from being frozen up. "Blowing off" will be found annoying, but this nuisance is largely caused by neglect of the driver, and is suppressible.

However, these are difficulties which will be overcome in time; using a condenser there will be practically no visible exhaust in all weathers.

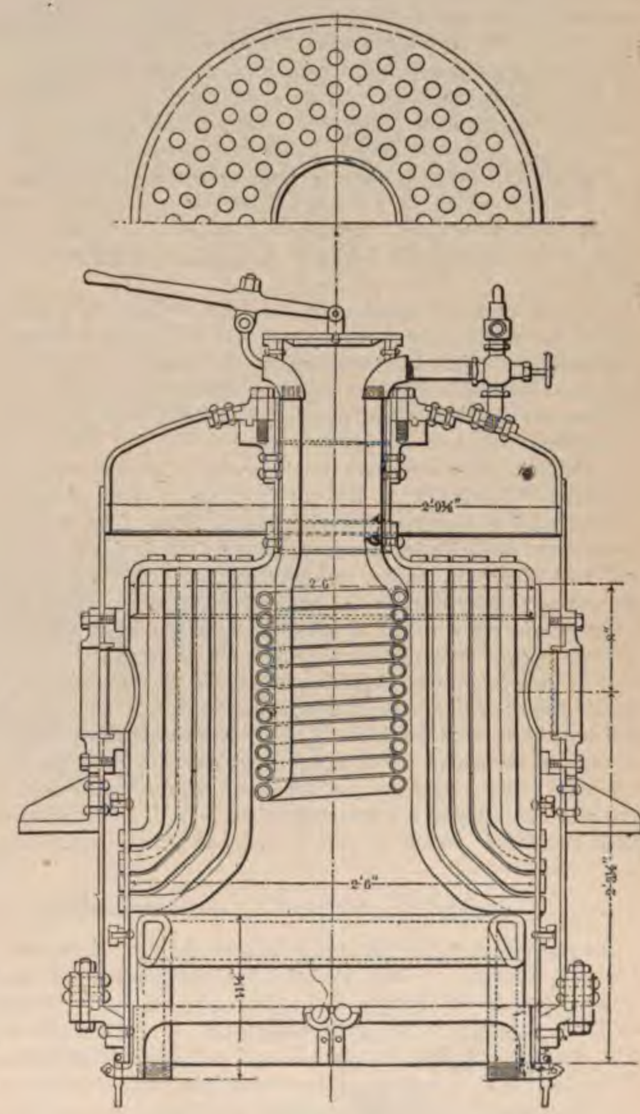


FIG. 4.

Condensers, however, are by no means desirable constituents of a motor wagon, and I would rather put up with an occasional cloud of steam than with a permanent shower bath due to leaky pipes and the difficulties in running a condenser. It can well be said that difficulties in connection with smoke have already been overcome.

The engine so far used is in almost every case a compound. If of vertical design it can be located under the driver's seat; while if of horizontal type it can be suspended from the body. In all cases a light and well-designed quick-revolution engine will answer the purpose if it is fitted with a reversing gear, and with means to admit high pressure steam to the low pressure cylinder. The cylinder ratio should be larger than with stationary practice, seeing that the pressure used is higher and that a large, low pressure cylinder means a powerful starting moment under live steam, and especial care has to be taken to connect the engine to the frame in an efficient manner. A fly wheel is sometimes fitted, and then used as a brake wheel, but I deem it unnecessary. As regards the size of the engine, I refer to tables appended.

Generally it can be observed that most of the wagons constructed are by far too light to stand the severe strain of their work. As is only natural, their cost of actual propulsion per gross ton is by no means as important an item as, for instance, in an electric vehicle, and one can, therefore, well afford to provide amply for a durable construction. A heavy wagon is just as easy to bring to a standstill as a light wagon—in fact, easier, since it may be fitted with quicker acting brakes, which, on account of their severe action, could not be fitted to a light construction. (Figs. 1 to 3 show a steam truck, built for the Adams Express Co. and designed by the author.)

The idea seems to prevail among some builders of steam wagons abroad that the driver should also effect repairs of the machinery, and that he should adjust the latter to suit himself. I rather think that this theory is against the economical exploitation of such wagons, more particularly if they are used in numbers.

In the latter case a concern would probably house a number of wagons in a shed at a distance from their center of work which would be too great to stable horses there. Such a shed would have facilities for firing up, taking aboard of hot water and fuel, dropping grates, cleaning and maintaining, which operations could go on partly from below and without necessarily interfering with the handling of merchandise.

There would be a foreman capable of adjusting the machinery, or of replacing defective parts, and the driver would merely have to be competent to operate the controlling organs and to take care of his boiler. Radical improvements in the storage of electricity or of compressed gases, or relating to explosive engines may yet put the steam wagon in the background; but judging from accomplished facts it is so far the most successful wagon for the economical transportation of heavy loads.

We publish by request the route followed by the Automobile Club of America in their Philadelphia run June 2: From South Ferry to St. George, S. I.; thence by the Amboy road to Tottenville, where the ferry was crossed to Perth Amboy. The route then lay through Metuchen, New Brunswick, Franklin Park, Kingston, Princeton, Trenton, Whitehorse, Bordentown, Mt. Holly, Moorestown, Merchantsville, to Camden, the ferry to Philadelphia being taken at the latter place.

## The No. 2 Locomobile.

The No. 2 Locomobile, of the Stanhope pattern, embodies a number of important improvements over the No. 1 model, chief of which are the following:

Tanks.—The water tank will hold 50 per cent. more water, viz., 25 gals. The gasoline tank and air tank have been made heavier and stronger. The gasoline tank will hold between 6 and 7 gals.

Engine.—The engine has been greatly improved and made heavier and stronger, the bearings enlarged and the balls removed from the eccentric bearings. The crosshead design has been improved.

Feed Water.—The water feed pump has been enlarged and connections strengthened. An auxiliary hand water pump provides an additional method of getting water into the boiler.

Safety Valve.—The safety valve blows off in the water tank without noise or appearance of steam.

Auxiliary Throttle Valve.—An auxiliary throttle valve has been placed on the carriage and the Locomobile may be operated by this valve as well as by the ordinary throttle. It is so arranged to act as a locking device when the carriage is left without attention.

Side Steering Lever.—No vibration.

Self-Feeding Oil Cup, holding oil enough for 75 miles.

Water Column.—A water column with gauge cocks has been put on the Locomobile, so that in case the water glass should break the water level in the boiler can be determined by the gauge cocks.

Dimensions.—The carriage body is longer and wider, and the seat roomier and more comfortable. The running gear is also somewhat longer, and the tread is now 4 ft. 6 in. The carriage will track in a country road.

Draft.—A side draft is used instead of the up and down draft. This will prevent any possibility of the fire burning back or blowing out.

## A Simple Friction Clutch.

The Empire Motor Works, 898-900 Washington St., Buffalo, N. Y., make a simple and practical friction clutch which we illustrate herewith.

Fig. 1 shows the clutch dissected, the several parts being as follows: A is the driver, which is keyed solid on the shaft. $B^1$ and $B^2$ are shoes surrounding A and hinged loosely upon it. C is the outer shell. By an error of the engraver C is made to appear as if its web were solid, but in reality the center is cut clear through instead of being merely recessed. The spreading pin F, with its wedge-shaped end, is a loose fit in A, and its inner end projects through a hole drilled for the purpose into the shaft, where it meets the tapered shifting key E, which lies in an axial hole bored in the shaft for that purpose. The two screws in the larger end of E come out through a slot in the shaft and hold E in engagement with the shifting collar D. When, therefore, D is shifted lengthwise of the shaft, the key E presses the pin F outward and the latter spreads the shoes $B^1$ $B^2$ till they grip the shell C. The hardened inset pieces X take the wear of the pin F. A spring (not shown) draws $B^1$ and $B^2$ together when the clutch is not in action.

Fig. 2. shows a pair of these clutches mounted on one shaft, with shifting for one speed backward and one forward.

## The St. Louis Automobile and Supply Co.

By the consolidation of the St. Louis Electric Automobile Co. and the Automobile Supply Co. of St. Louis, a new company, the St. Louis Automobile & Supply Co., has been formed. It is incorporated under the laws of Missouri, and it has a capital stock of $10,000, all paid in. The officers are B. C. Keeler, president, and Peter O'Neil, treasurer. A. L. Dyke, who designed the electric vehicles of the St. Louis Electric Automobile Co., and who originated the Automobile Supply Co., will be retained as manager. A factory has been erected near the corner of Twenty-third and Locust Sts., and the company will continue to supply the trade with high class goods in the way of running gears, and also with gasoline engines of their own make. They will continue to manufacture their electric runabout. The address of the new company will be at their factory, Twenty-third and Locust Sts., as above.

## COMMUNICATIONS.

### A Small Engine.

Reading, Pa., June 4.

Editor Horseless Age:

I should like to learn the proper dimensions for the compression chamber of a two-cycle gasoline engine whose diameter of cylinder is 2¼ in., with 2¾-in. stroke. Also, can a sufficient amount of carbureted air be forced into the compression or explosion end of the cylinder by utilizing the other end as an air pump? What should be the size of the inlet and of the exhaust ports? J. V. E.

[If the compression chamber is made of the same diameter as the bore, viz., 2¼ in., it should be about 1⅜ in. deep, making its volume a little more than one-half the volume swept by the piston after closing the exhaust port. If the parts of the igniter which project into the cylinder are bulky, they should be allowed for.

It is usual to inclose the crank case and use it as a pump for the mixture, but it would be possible to lengthen the cylinder instead, using a piston rod running through a stuffing box and a crosshead working in guides. The compression in the crank case or in the extended end of the cylinder should be about 6 lbs. per square inch gauge, when the inlet or transfer port in the cylinder is uncovered; and this, if we assume a vacuum of 2 lbs. per square inch at the end of the suction stroke, would require a cubic space of about 16 in. for the volume into which the mixture was to be compressed. As the area of the bore is practically 4 in., the necessary length of the pump end of the cylinder would be 4 in., using a flat disk piston. If a trunk piston is used, its inside space should be deducted from the 16 cu. in. before dividing by 4. Allowance should also be made for the capacity of the transfer pipe connecting the two ends of the cylinder. It would be an advantage to make the transfer pipe very liberal in diameter, say 1¼ in., and thereby shorten the pump end of the cylinder and insure a quick transfer of the charge. If the transfer pipe were too small or crooked, it might be necessary to increase the compression in the pump end, but this should be avoided if possible.

Good proportions for the exhaust port will be, width, 7-16 in., with following edge flush with the top of the piston when the latter is at the end of its stroke, and length, 2¼ in., measured around the piston. The inlet or transfer port, if opposite the exhaust port, may be ¼ in. wide by 1¼ in. long, with its following edge also flush with the top of the piston, as above.—Ed.]

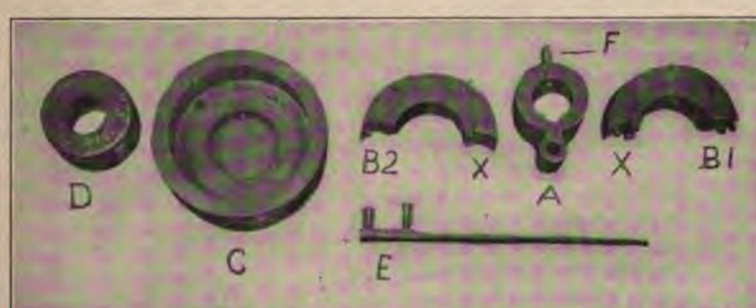
### How About Their Life?

Providence, R. I., June 6.

Editor Horseless Age:

In your issue of May 30, "Steam Carriage No. 2" speaks of using two cells to operate a spark coil to ring a bell and operate a flash road lamp, besides a lamp at each of the two gauges. Will he kindly state how long his battery lasts?

JOSEPH ANGLADA.




THE EMPIRE CLUTCH. FIG. 1.

THE EMPIRE CLUTCH. FIG. 2.

### Packed vs. Ground Joints.

New York, June 11.

Editor Horseless Age:

Answering the inquiry of "Auto," would say that asbestos cardboard is all right as a non-conductor of heat, but I do not think it is of much use as a packing on gas engines. It may last some time, but there is nothing like a ground joint at any point in connection with the combustion chamber of the engine. If a packing must be used, let it be a corrugated copper one. H. W. S.

# LESSONS of the ROAD

On Saturday, the 26th ult., Geo. L. Weiss, of Cleveland, O., and J. W. Packard, of Warren, O., made a trip from Cleveland to Buffalo in Mr. Weiss' automobile. This machine is one of the standard road machines built by the New York & Ohio Co., at Warren, O. The departure from Cleveland was made at 5 a. m. and Buffalo was reached before 9 p. m. The actual running time was thirteen and a half hours, and the distance covered 225 miles. Ashtabula, approximately 60 miles from Cleveland, was reached in three hours' running time, and Erie, 100 miles, in six hours. The last 30 miles of the run into Buffalo was made after dark on strange roads, necessitating a greatly reduced speed. The roads in general were good, at which times a speed of 18 to 22 miles an hour, the maximum for which the carriage is geared, was easily maintained. Some very bad stretches of road, however, were met with, and the hills, while few in number, were of heavy grade.

Considerable amusement was afforded the travelers by their being practically refused accommodations at one of the prominent Buffalo hotels where they first applied. This was doubtless on account of their travel-stained and begrimed appearance, although the usual plea was made that they had no suitable rooms to let.

The journey was made not only as a pleasure trip, but with a view to thoroughly testing the long-distance capacity of the machines used. Not a single breakdown or accident of any kind was met with, either to the automobile or to the horse-drawn vehicles passed on the way. Many parties along the route complained of the very reckless behavior of motor carriage drivers passing over the road, and it is not unlikely that unless common politeness and due care are used, restrictive measures may be put in force by the local authorities.

## A Failure, but Dangerous.

The omnibus and cab proprietors of Aberdeen are up in arms against the introduction of motor car services into the city. A meeting was held lately, at which Councillor James Gray presided. Among the many extraordinary things reported to have been said by that gentleman was a statement to the effect that "as the result of inquiries in London, he was convinced that in other parts of the kingdom motor cars, as a means of dealing with passenger traffic, had proved a colossal failure." So firmly was he convinced of this that "had he £10,000 in the bank—a sum he neither had, nor ever expected to have—he would not invest a penny in what he felt to be a fraud, a delusion and a snare." As the result of the meeting, a committee was formed "to look after the interests of the 'bus proprietors."—Scottish Cycling.

In the "Critérium des Voiturettes," run off over the Etampes-Chartres 100-kilometer course on May 17, under the auspices of Le Vélo, there were two classes, viz., of vehicles not exceeding 250 kilos in weight, and the other for those up to 400 kilos. In the second class the race was won by Cottereau in 1 h. 44 m. 57 3-5 s., breaking the previous record by 3 m. The first class was won by Tart in 2 h. 12 m. 31 s. Cottereau's vehicle weighed 390 kilos and Tart's 195 kilos.

# OUR FOREIGN EXCHANGES.

## Road Locomotion.*

By H. S. Hele-Shaw.

*(Concluded.)*

### STEAM GENERATORS.

The two most important considerations with the design of a steam boiler for motor vehicles are, first, to have a boiler as light as possible consistent with high pressure, and, secondly, to have a type of boiler which is capable of being forced so as to meet a sudden demand for an increased quantity of steam at a higher pressure. The latter point really constitutes, as has already been pointed out, one of the great advantages of steam for a motor vehicle, and in many designs has enabled change of speed gearing to be dispensed with, since in engines working under the compound system arrangements are made to use high-pressure steam in both cylinders in order to surmount a hill or to transport a heavy load over a piece of bad road. Hence it is that water tube boilers of various types have been found particularly suitable, while, as far as the author is aware, one type of fire tube boiler is used for motor wagons.

### WATER TUBE BOILERS.

One of the most successful water tube boilers is that of the Thornycroft Steam Wagon Co., Chiswick. This boiler is represented in section in Fig. 4 and really consists of two separate annular portions, A and B, almost rectangular in section, connected by a number of cylindrical straight water tubes which form the walls of a slightly tapered hollow cone, C C. The furnace D is contained in the hollow of the lower annulus B, being fed through the opening in the upper annulus A, through the cover E, which can be removed for the purpose. The flame has to find its way on all sides through the narrow spaces left between the water tubes, the products of combustion escaping by means of the funnel F.

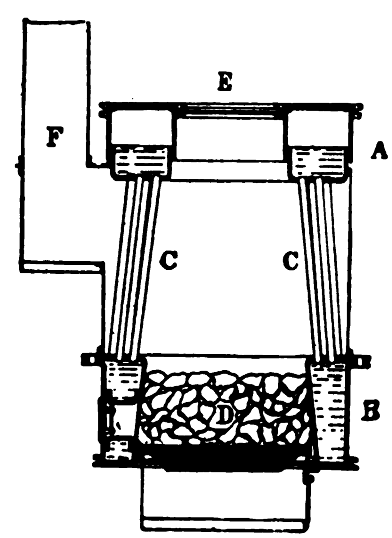



FIG. 4.

* Extracts from a paper read before the Institution of Mechanical Engineers, April 26, 1900.

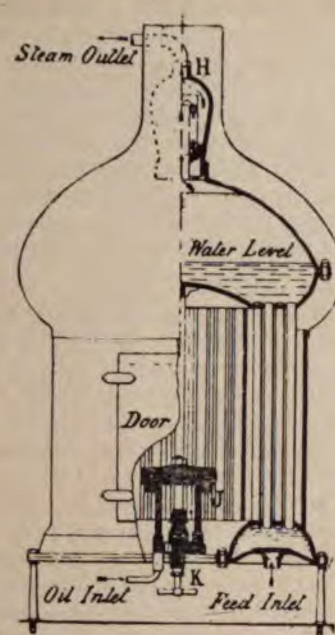



FIG. 5.

The boiler next illustrated, as shown in half section elevation (Fig. 5) is in some respects similar to the Thornycroft (Fig. 4). The products of combustion, however, in this case escape entirely around the upper portion, thereby adding a feature of economy to this type of boiler, for perfectly dry steam is increased by the steam dome H being contained in the smoke box. The heating is effected by means of a petroleum burner, J, the supply of which can be regulated by means of the screw valve at K. Merryweather & Co. have a boiler specially suitable for motor vehicles represented in Fig. 6. The feature of this boiler is the large size of fire box, L, which is entirely surrounded by the water space.

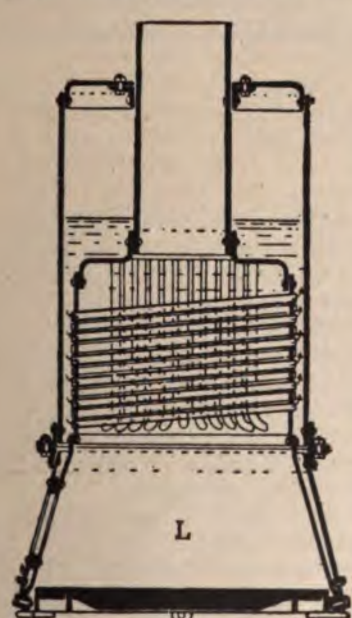



FIG. 6.

The flames pass upward, encountering a double set of water tubes, one being straight and slightly inclined from the horizontal, and the other being curved and vertical, and from their position insuring a very complete circulation of the water above the furnace. The De Dion boiler, shown in Fig. 7, is better known in France than in this country, but at the Liverpool trials on the Bayley wagon it proved itself a very efficient steam generator. It consists, like the Thornycroft, of a double annulus of rectangular section, connected by water tubes, the essential difference between these two boilers being

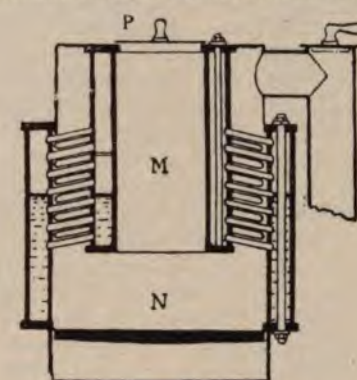



FIG. 7.

that one annulus, M, is much smaller than the other, being partly contained in it; the water tubes connected with them, instead of being vertical, as in the Thornycroft, are slightly inclined from the horizontal. The furnace N, as in the case of the Thornycroft, is fed through a cover, P.

FLASH BOILERS.

This type of boiler, in which a small quantity of water is injected at each stroke of the engine into a heated coil of metal to be flashed into steam and superheated, is by no means new. More than twenty years ago a small engine of this type, the invention of Henry Davey, of Leeds, was working in the engineering laboratories of University College, London, and gave about ¾ h.p. Prof. Kennedy, who showed it to the author, at that time expressed a favorable opinion of its future possibilities; but it cannot be said that this type of boiler had really come much to the front until it was revived by Serpollet a few years ago in connection with motor vehicles. The boiler of M. Serpollet has undergone a considerable modification during the past year. It originally consisted of a battery of thick steel tubes, jointed together by bends outside the furnace, the thick steel tubes, which were originally circular, being squeezed together, and finally indented so as to give a kidney-shape section, the concave side being toward the flame, and a very narrow space left for the water to pass through. M. Serpollet has now modified his boiler so that it consists of two portions, the lower being thick steel tubes twisted into a helical form and placed so as to intercept the flame as much as possible, as shown in plan and elevation A A (Fig. 8). The upper portion consists of a coil, B, of cylindrical tube of lighter section, and not twisted as in the lower portion, which is exposed more directly to the flame. The heating, which was originally effected by coke or coal furnace, is now done by means of a petroleum burner. Simpson and Bodman have a very strong and effective flash boiler, which is shown in sectional elevation and side elevation in Fig. 9. This boiler consists of a series of heavy steel tubes, C, indented after the

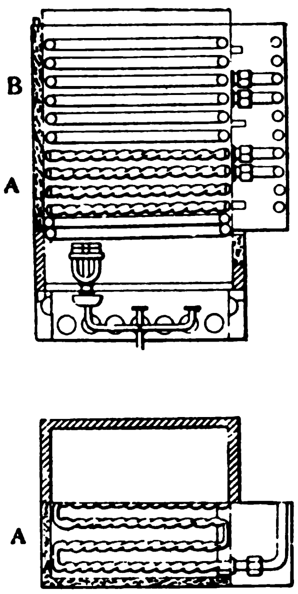



FIG. 8.

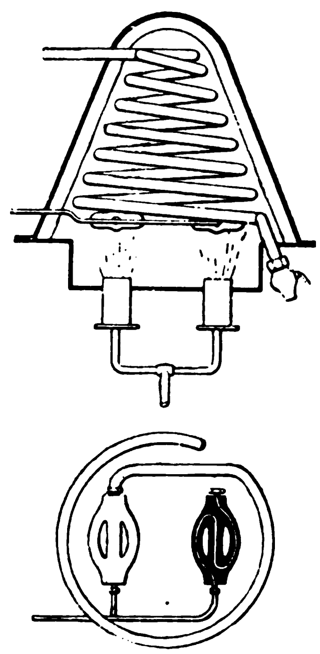


FIG. 10.

Row condenser pattern and connected outside the furnace by a Haythorn joint, E E, which is shown in section. The Row indentations alternate about 168 times in the generator, and any fluid passing around them must encounter an amount of baffling that would expose it in the most effective way to the action of the heating surface. The steam is made to pass through a drum, D, which is found necessary to prevent the superheated steam having too high a temperature. The boiler is heated by a coal furnace, F F, and in about 40 minutes from lighting the fire steam is generated. There are many boilers, of course, in which steam can be generated more quickly, but it must be remembered that the success of this type of boiler depends upon a reasonable mass of metal in which heat can be stored. Tangye's boiler (Fig. 10) is convenient and compact in form and consists of a single coil of steel tube in conical form; the burners are shown in plan. One of the newest forms of combined boiler and burner is that of C. and A. Musker, of Liverpool (Fig. 11). This is placed in a horizontal position underneath the vehicle, requiring no chimney for the escape of the waste products of combustion. It consists of three cylindrical coils, H H, of strong steel tubes, and the flame is made to circulate in the annular space between them. The point at which the water enters is shown on the drawing, and likewise that at which

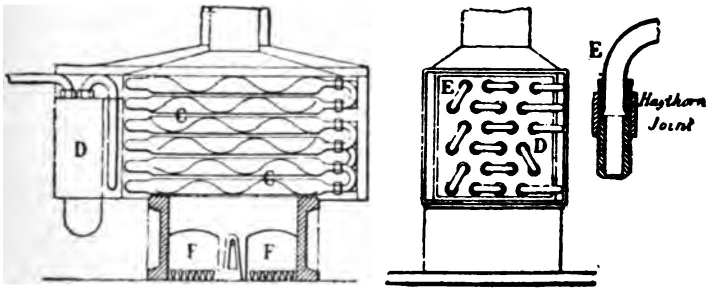



FIG. 9.

the steam is supplied to the engine. In a test made by the author on one of these boilers, it was found that in a period of 40½ minutes 37½ gals. of water were evaporated, the steam gauge remaining during this period almost absolutely steady at 300 lbs. per square inch. To evaporate this quantity of water 3½ gals. of commercial petroleum were used. As the weight of this boiler and contents, independently of the burner, was only 4 cwt., this represents, roughly, 15 lbs. per horse-power, and indicates the great steaming capacity of this type of boiler and its suitability for motor vehicles.

### GEARING OR TRANSMISSION.

The ordinary modes of transmitting power, viz., by friction gearing, toothed wheels, belts and chains, have been specially adapted and employed for transmitting the power from the motor to the driving wheels of a motor vehicle. The requirements for this particular purpose are in many respects of a special character, and the author had collected material for a special section of the paper devoted to this subject. It has become evident, however, that it would be impossible to treat the question in a satisfactory manner within the limits of this paper, and the subject well deserves a special paper before the institution. Take, for instance, the transmission of power by chain gearing. This mode of transmission, from being in a very crude state a few years ago, has received so much attention that chain gearing is as efficient as, if not more so than, any other mode of transmitting power, whereas the wearing of the links of the chain, which, as it occurs, gives so much trouble and annoyance, has been met by the special provision of large bearing surfaces, which are hardened, so that the mechanism of the chain gear may be said now to compare favorably with the other working parts of engine,

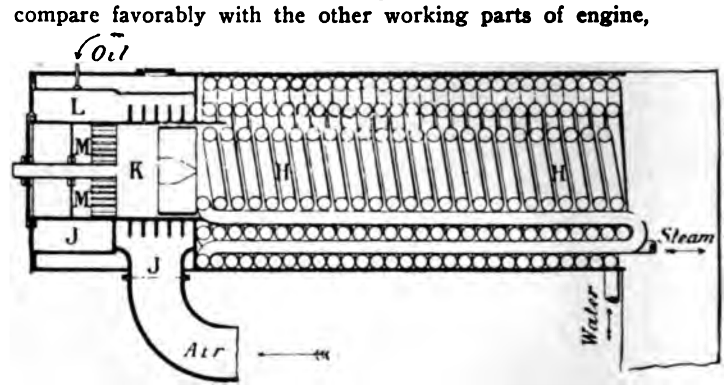



FIG. 11.

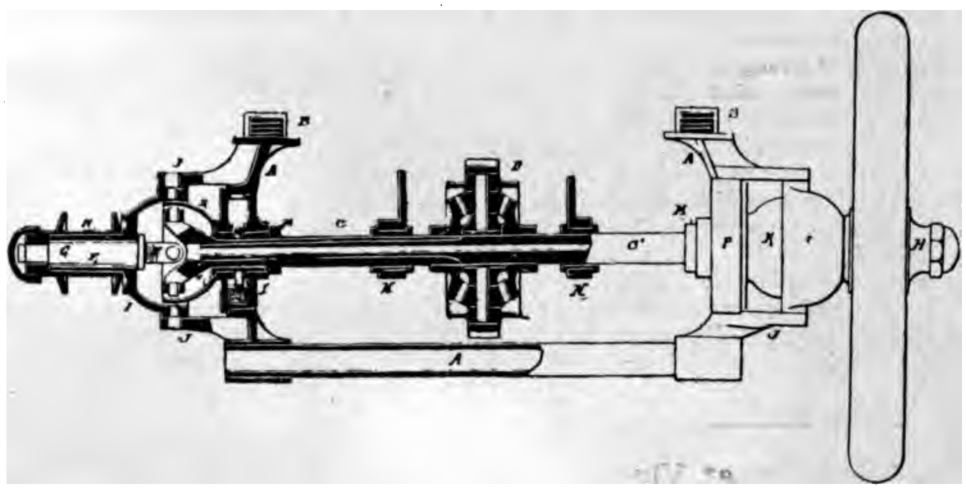
such as crosshead pins and main bearings. The efficient lubrication of the chain is a matter of the greatest importance and difficulty. The grease chiefly requires to be inside the joints, and Major R. E. Crompton showed the author a most ingenious way of effecting this, which he has most successfully employed with bicycle chains. He places the chain in a bath of melted grease, in which graphite is mixed. The air being expelled from the joints of the chain by the heat, the mixture naturally finds its way between the pins and rollers, and forms a complete internal solid lubricant, when the whole is allowed to cool together.

The Renold chain, which is largely used in heavy motor traffic, is a beautiful invention, which meets in a most ingenious manner the change of alteration of pitch due to wear, and the latest improvements in this chain are also designed to obviate as far as possible the wear upon the pin itself and reduce it to a minimum.

Again, one special feature of the oil engine is the necessity for change of speed gearing of some form or other, and this has led to a large number of arrangements of speed gearing which of themselves are worthy of detailed consideration. Besides the arrangements for changing the speed ratio by means of combination of toothed wheels are inventions such as the expanding and contracting pulley of Mr. Lucas, the arrangement for altering the throw of an eccentric through which the power is transmitted, such as in the invention of Mr. Newton, and last, but not least, the most ingenious hydraulic variable speed gear of Mr. Hall. These inventions are all in actual operation with apparent success; but unless actually examined they could not really be understood, except by means of drawings with detailed description.—The Mechanical Engineer.

## The Automobile Fête at Vincennes.

It was on Sunday afternoon [May 19] that the Vincennes annex of the Paris Exposition gave its first real signs of life, for hitherto the chaste assembly of unfinished buildings, unaided by any outside attractions, has quite failed to secure any attention from the general public. But on Sunday conditions were wonderfully different. Not that the Exhibition buildings or the installation of the various stands had undergone any remarkable advance; indeed, they presented a melancholy spectacle of incompleteness and unattractiveness little likely to account for the huge influx of visitors. No; the public had not journeyed all the way to Vincennes to see the so-called Exhibition, but to witness the first of those fêtes which the Automobile Club of France is this year organizing to take place on the road running round the Lac Daumesnil. Certain it is that no sport has a greater hold upon Parisians than automobilism, and in providing a series of fêtes and competitions the Exhibition Commissioners knew full well that they were adopting the best possible means to attract visitors to Vincennes. For without the certain knowledge that excellent sport is to be seen, but few people would take the trouble to make that tedious journey to and from the annex, especially on a Sunday, when every means of transport is crowded to excess. But last Sunday all were assured of good sport, for was not the programme in the hands of those two well-known organizers, MM. Jeantaud and Ravenez, and accordingly every one set out from Paris with perfect tranquillity. Proceedings were timed to commence at 2:30 p. m., but half an hour before that the roped-in road running around the Lac Daumesnil was lined with spectators, who scanned with interest each car as it appeared upon the scene. And I can assure you that there were a few to scan. They seemed to be numberless, and ranged in size from the diminutive voiturette to the huge steam omnibus. And they brought with them all the celebrities of the automobile world. There the Baron de Zuylen, on a 12-h.p. blue-painted Panhard; there Georges Lemaître on a Peugeot voiturette, M. Mors on a dog cart, M. Santos-Dumont on a Stanley electric, Comte de Dion, MM. G. Rives, Michelin, Avigdor, Archdéacon, Renault, Bardon, Richard, Forestier, A. Baillif, Pierre Lafitte, Kriéger, Paul Rousseau, de Diétrich, Georges Prade, Thévin and a thousand others. Quickly the grand stand filled, and when at last a start was made with the programme hardly a vacant place was to be seen. The seat of honor was occupied by Alfred Picard, the Commissioner-General of the Exhibition, and he was supported by many high officials, in addition to the leading members of the A. C. F. But the personage whose presence sent a thrill of pleasure through every motorman at Vincennes that Sunday afternoon was M. Lépine, the Préfet of Police, under whose personal direction the precautions for the public's safety were carried out. Here was the opportunity of chauffeurs to demonstrate to M. Lépine how perfectly under control were their vehicles, and I am bound to say that the drivers rose to the occasion and displayed a skill and discretion worthy of all praise. Not a mishap, even of the most trivial character, occurred to mar the afternoon's proceedings, and M. Lépine could not but be favorably impressed with the practical demonstration thus offered to him. The officials undoubtedly had this object in view when they directed that each vehicle should be driven up before the stand at a great rate of speed and then suddenly stopped. Their confidence, both in the drivers and in the machines, was not misplaced, for vehicle after vehicle was pulled up in the most startling manner, the displays made by Madame Gobron on her beautiful Gobron-Brillie car and Dominque Lamberjack, mounted on an Amédée-Bollée, being particularly noteworthy. This item was perhaps the most interesting on the programme, at any rate to those intimately in touch with automobilism, but the gymkhana events also excited much attention. There was an egg race, a needle race, apron and skittle races, competitions with buckets, handkerchiefs, rings, and obstacles—indeed, all that could be devised to amuse the spectators and give the competitors a chance of showing their skill. As is usually the case in programmes of this nature, the Decauville drivers and cars showed to great advantage, some of the evolutions made by them being simply astounding. Then came a game of alleged polo, but it bore no resemblance to any game that I have ever seen, for some half dozen large balls were in use at the same time and the players were absolutely indifferent as to the direction in which they smote these balls. Everybody having won, a sort of triumphal march of a snaky nature was indulged in by all the voiturettes engaged in the fray, and then a start was made with the *défile général*. Considerably over two hundred vehicles participated in this promenade, led by the Baron de Zuylen. And what a truly marvelous collection of types—racers and tourists, steam and electric, wagonettes and dog carts, cycles and voiturettes, omnibuses and drays, all gaily decorated, and sporting the dainty commemorative banners handed to them. It was a sight to gladden the heart of a motorman, even if he was afoot and smothered in the dust swept up and deposited upon him by self-propelled friends. And in the midst there suddenly arrived, unannounced and all forlorn, a postoffice cart drawn by one of those curious animals now rapidly becoming extinct—a horse. He walked soberly and majestically along the track, until, before the grand stand, his progress was arrested a moment while a commemorative banner was solemnly handed to his driver, and then he resumed his stately march, unheeding the shouts of laughter which greeted him on every side, and ignoring equally the rush and clatter of his mechanical rivals. Good old gee-gee, you are not such a bad sort after all! With the *défile* proceedings terminated, those of us unblessed with cars—and I suppose that we numbered some ten thousand dusty mortals—set out for Paris, where we ultimately arrived, having made the four miles in about seventy minutes, thanks to the surpassing rapidity of the horse-drawn trams. A more inaccessible spot than Vincennes could hardly have been selected within the environs of Paris, but then every one is presumably supposed to motor there.—The Motor Car Journal.



GEORGES AVERLY COMBINATION AXLE.

## Some Recent French Patents.

DRIVING AND STEERING AXLE.

This is the invention of Georges Averly. It is composed:

1. Of a bent framework, A A, on which the fore part of the body rests through the medium of the suspension spring shown in section at B B.

2. Of two hollow steering axles, F, pivoted to the framing A.

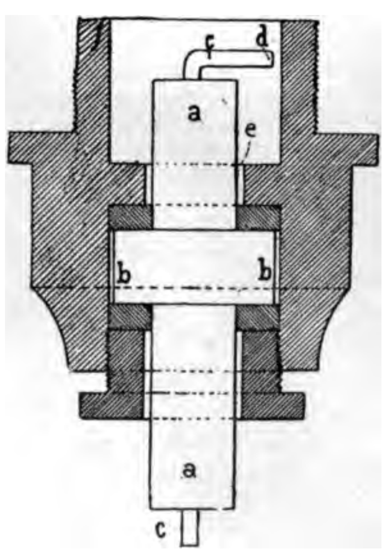
3. Of a divided axle, C C', driven by the differential D, which is of the usual form.

The two segments C C', controlled independently by the differential, are made so that one enters the other for a portion of its length, thus securing their concentricity. Bearings are provided at N N and at P, the latter being arranged with oil wells and oil rings, as shown at L, and the longer segment C' extends to and beyond the bearing L for better support.

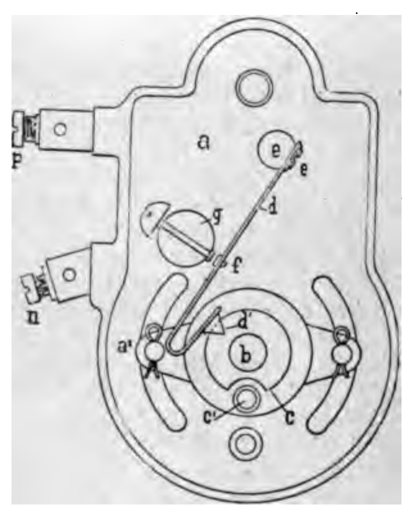
The axle segments terminate, beyond the bearings, in universal joints, which transmit the power to short spindles G inside the steering axles F. These spindles G are connected at their outer ends to the hubs H of the wheels, which run on the axles F. A hemispherical shell, K, incloses the inner half of each of the universal joints, and a complementary shell I is formed between the axle F and its pivot J; and the edges of these shells overlap so that dust is excluded at whatever angle the wheels may be swiveled. The bearing boxes P are made circular and secured in the frame so that by their removal the axle segments may be withdrawn laterally without detaching the differential gears from them. Slip collars, M, hold the axle segments in their normal position.

IGNITION PLUG.

Patented by the Société des Automobiles Peugeot. It is stated in the specifications that the chief difficulty with ignition plugs heretofore has been their liability to gather carbon when an excess of cylinder oil or a bad mixture is fed to the engine. The fact that ignition tubes are not similarly affected is attributed to the outward rush of burning gases from them




PEUGEOT IGNITION PLUG.




TREMBLER OF CHAVANET, GROS & PICHARD.

at the moment of ignition, which sweeps the tube clean. The object of this invention is to secure a like benefit for the ignition plug, and to this end the latter is formed as shown in the figure, with a recess of suitable depth, and the sparking point is placed as far within it as possible, having regard to the fact that the inner end of the recess will be occupied by burnt gas and that the fresh mixture must reach the spark.

In the figure, d is the sparking point and a is the porcelain tube, flanged at b and compressed between two washers of amianthus or soft asbestos. An annular space is left at e, and the distance between the stem c and the metal flange at the base of the recess is an important factor in preventing short-circuiting of the spark.

ELECTRIC TREMBLER.

Patented by the Société Chavanet, Gros et Pichard. The cam is circular, and its rise is in the form of a roller, c′, which works against the rubbing point d′ of the spring d in the usual manner. The vibrating contact is at f, and the insulating base, a, on which the spring and contacts are mounted, may be adjusted in its angular position about the cam spindle b as a center.

## Employment of Aluminum in the Construction of Automobile Vehicles.

Much interest attaches to the lightening of all the parts of automobile vehicles, especially of motocycles and small vehicles of limited power. With equal power, all saving of dead weight allows of an increase in the furnishings or an augmentation of the weight of the motor rendering it more powerful and capable of greater velocity.

As this lightening cannot be secured, except within narrow limits, by diminishing the size of the pieces without diminishing their power of resistance, and increasing the danger of breakage and other accidents, constructors are interested in securing a lighter material. Aluminum supplies this want, and its use for the construction of certain parts of automobiles has recently been considerably extended. It has a density of 2.56. Thus, with equal volume, it weighs some three or four times less than copper, bronze, cast iron, etc.

Alloys are now made containing not more than 3 per cent. or 4 per cent. of the heavy metal. These alloys do not exceed 2.8 to 3 in density, and have a breaking limit in tension of 16 to 18 kilograms per square millimeter, with extension of 2 per cent. to 3 per cent. for pieces cast in sand. It is even possible to secure a resistance of from 25 to 30 kilograms, but with less elongation.

Rolled or drawn, alloyed aluminum may yield even from 30 to 36 kilograms of resistance per square millimeter to the traction, with elongation from 10 to 15 per cent.

It is seen then that, compared with bronze, the advantage is altogether in favor of aluminum.

Compared with cast iron or steel, the advantage is similar, for the resistance of an aluminum piece being about one-half of a steel piece of equal dimensions, it is sufficient to double the sections to afford the same resistance as steel; but its density being one-third that of steel, there will still be, with equal resistance, an advantage in the weight of one-third, under the most unfavorable conditions.

Aluminum and its alloys are now prepared and cast with as much regularity and excellence as bronze or cast iron. Numerous pieces, thoroughly tested by actual use, have given full satisfaction.

The elastic limit of cast aluminum being considerably lower than that of cast iron, sudden breakage, to which the latter is subject, is much less to be feared. It may be said to be unheard of.

Framework, motor casings, carbureters, crosspieces, stays, pedestals, plates, connecting boxes, transmission pulleys and other parts are now made of aluminum.

For framework aluminum possesses the advantage that it can be used for all the bossages, supports, ribs, etc., avoiding considerable hand work in adjusting, a saving which it would be impossible to secure with frames composed of several pieces. This result can only be reached by casting, and aluminum alone, from its lightness, allows of the necessary thickness without too great weight.

It also allows of increasing the moment of inertia, and consequently the stiffness of the supporting pieces, without a considerable augmentation of weight.

For moving parts, especially in machinery running at great velocity, aluminum has the decided advantage, in consequence of the light weight of these pieces, of diminishing the inertia, and consequently the strain of the pieces and the shocks and jarring affecting the whole structure.

For transmission pulleys, aluminum promotes an adhesion of the belts much greater than that of cast iron, an important advantage for automobile vehicles, in which the length of the belts, necessarily quite restricted, is the cause of slipping and falling off.

Another advantage of aluminum is that it is but slightly sonorous, and its use deadens the noise of the mechanism to a certain extent. Thus, exhaust parts, completely silent, are now made of aluminum.

The working of this metal presents little difficulty, if the alloys are well made and adapted to their purpose. They can be turned, drilled, tapped and planed like bronze. The tools ought to be a little sharper than for bronze and copper, and it is well to make use of soapy water or oil to moisten them.

The casting alone presents a little difficulty with respect to the composition of the alloys and the method of testing it, and with respect to the moulding.

The moulding is in sand, as for copper, bronze or cast iron, with some differences caused by its low density, which necessitates ample casting holes, large vents and copious supplies of the metal.

The composition of the alloys and their treatment are the secret of the manufacturers. On these depend to a great extent the quality of the product.

Aluminum is not much higher in price than bronze of good quality. Its density being but one-third that of bronze, the cost of the same volume is but little more. The difference is amply compensated for by the advantages derived from its use.—Journal de l'Electrolyse.

**We are informed that the Société Anonyme des Automobiles Canello-Dürkopp, whose office is in Courbevoie, Paris, and works are in Bielefeld, Germany, is looking for an agent to handle its motor carriages in the United States. They wish inquiries to be addressed to them at the Bielefeld works.**

**ACETYLENE MOTOR NUMBER JUNE 20.**

## MINOR MENTION.

It is reported that an automobile club will be formed at Yale University in the fall.

Jules Verne and Emile Zola have lately been quoted in praise of the automobile.

The American Automachine Co., of New York City, has been incorporated with $120,000 capital.

We have received the circular of the Eastman Automobile Co. describing their steam carriage.

A charter has been applied for by the National Automobile Co., Wilmington, Del., capital, $1,000,000.

The Police Board of Hartford, Conn., has been asked to appropriate $4,000 for a motor patrol wagon.

The Honesdale Automobile Vehicle Co., of Scranton, Pa., has been incorporated with a capital of $100,000.

An automobile will run between Onteora Park and Tannersville, N. Y., this summer, for the purpose of carrying the Onteora Park mail.

It is proposed to run an automobile line on Orange St., New Haven, Conn., in place of the horse "stage" line now operating.

A number of electric vehicles have been shipped from New York to the City of Mexico, to the order of the Mexican Electric Vehicle Co.

The Bordeaux-Périgueux-Bordeaux race was run on June 3 and 4, having been sanctioned at a late date. Particulars will be given in our next issue.

The Automobile Club of America has arranged two more tours, one to Bernardsville, on Saturday, the 16th, and the second to Asbury Park, via New Brunswick, on the 20th.

A "Whitsuntide tour" of the Automobile Club of Great Britain was made last week from London via Peterborough to Cambridge, returning via Rayston, Hatfield, Barnet and Finchley.

The Co-operative Wheel Co., Toledo, O., has been incorporated with $5,000 capital, for the purpose of manufacturing and dealing in bicycles, tricycles and other vehicles, including those mechanically propelled.

The Compagnie Routière de France will run a 15-h.p. Panhard break, carrying 12 passengers, daily through the season from the Herald office, in Paris, out to Fontainebleau. The distance each way is about 45 miles.

The Newport City Council has been petitioned to restrict the speed of motor carriages in the public streets. It is reported that the undue speeds indulged in by one or two young men of wealthy families have prompted the protest.

A hilarious Washington young man lately started an automobile which had been left standing at the curb by its owner. He was arrested, but released because there was no ordinance to fit his case. The authorities are now at work getting out a regulation to supply the want.

The Count de la Valette, technical secretary to the Automobile Club of France, is about to go to Madagascar for the purpose of starting a public service of motor vehicles, and is taking six specially constructed vehicles with him, each fitted with motors of 12 h.p.

The New Process Raw Hide Co., Syracuse, N. Y., has sent us an interesting little catalogue describing their product. Their noiseless rawhide gears and pinions are well known, and they recommend rawhide bushings for loose pulleys and other places where lubrication is difficult.

We learn that C. J. Field is in Europe closing up important negotiations for the establishment of a large company controlling the American rights for one of the best known manufacturers of automobiles in Europe. We will be able to give details on Mr. Field's return the latter part of June.

The Locke Regulator Co., Salem, Mass., send us a neat circular describing and illustrating their standard steam carriages, tubular frames and running gears for steam stanhopes, and their carriage engines and boilers. These engines are of the twin-cylinder, double-acting type and are made in three sizes of 2½ x 3½ in., 2¾ x 3¾ in., and 3 x 4 in. cylinders respectively. They have link cut-off and balanced valves and are substantially constructed. The boilers are of three sizes, to suit the engines, and have copper tubes and steel heads. The two smaller sizes have copper shells as well, while the largest has a steel shell. The company makes also gasoline burners, steam and air pressure gauges, glasses, regulators, injectors and other steam fittings for vehicles.

## Better Controlled than Horses.

The Westminster Gazette's special representative on the 1,000-mile trial bears testimony to the wonderful control under which automobiles are in the hands of competent drivers. On April 25 he writes: "In reference to the present limit of 12 miles an hour, a few remarks may be made. Travelers may remember a certain very steep hill leading down into Marlborough, at the top of which that beautiful town comes suddenly into view. Last Monday the Hon. J. S. Montagu was driving his 12-h.p. Daimler down this hill at a fair speed, when suddenly a horse coming upward shied into the middle of the road, presenting an impassable barrier to progress. If Mr. Montagu had been riding a bicycle he would probably have been killed, or if he had been driving a horse he would have stood a small chance. As it was, on his motor car one passenger turned very pale, and, personally, I confess that I stopped puffing my pipe; but the driver quietly put on some of his brakes and within a few yards the car was standing still. A similar instance occurred in Tewkesbury yesterday, when the Richard car I was riding on was traveling rather closely to the car in front. Suddenly we heard an awful screeching issuing from the internal regions of the vehicle we were following, and at once, something having broken down—goodness only knows what—it came to a complete standstill. In this case again, if we had been riding any other kind of vehicle than a motor car, we would probably have been injured, but as it was we pulled up with a good half yard to spare. I bring forward these instances, which are only two out of many, as examples of the arguments upon which automobilists base their contention that the present legal speed limit through country districts is fixed too low."

# MOTOR VEHICLE PATENTS of the world

## UNITED STATES PATENTS.

650,412—Shaft Coupling.—Robert K. McLellan, of New York, N. Y. May 29, 1900. Application filed Oct. 13, 1899.

650,415—Vehicle Hub.—Rescue B. Page, of Fresno, Cal. May 29, 1900. Application filed Oct. 21, 1899.

650,437—Automobile Vehicle.—W. W. Valentine, of Washington, D. C. May 29, 1900. Application filed May 1, 1899.

650,516—Power Driven Vehicle.—E. E. Molas, E. J. Lamielle and H. F. A. Tessier, of Paris, France. May 29, 1900. Application filed Aug. 16, 1899.

The object of this invention is to overcome an assumed tendency of the ordinary jack-in-the-box differential to deliver a greater tractive effort to the inner wheel, when the vehicle is following a curve, than it does to the outer one; and the invention consists in connecting the hubs of the driving wheels to the axle by means of two friction clutches, which are so connected to the steering gear that that of the inner wheel is tightened and that of the outer wheel relaxed, in degree proportionate to the sharpness of the curve which is being followed.

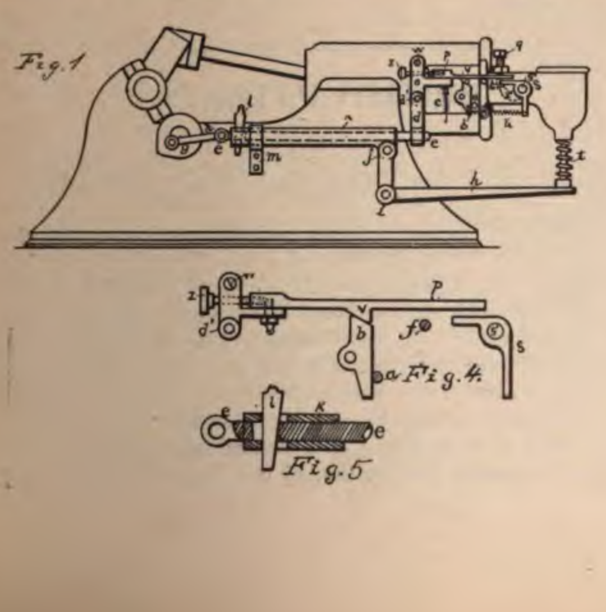
Three claims.

650,549—Gas Engine.—F. W. Toedt, of Hamburg, Ia. May 29, 1900. Application filed Jan. 30, 1899.

An arrangement of "serpentine gas chambers" in the cylinder heads, through which the explosive mixture is forced on its way to the cylinder, and in which it is ignited and made to burn before acting on the piston. The engine is double acting, with no provision for cooling the piston rod, and an ordinary piston valve releases the exhaust.

Two claims.

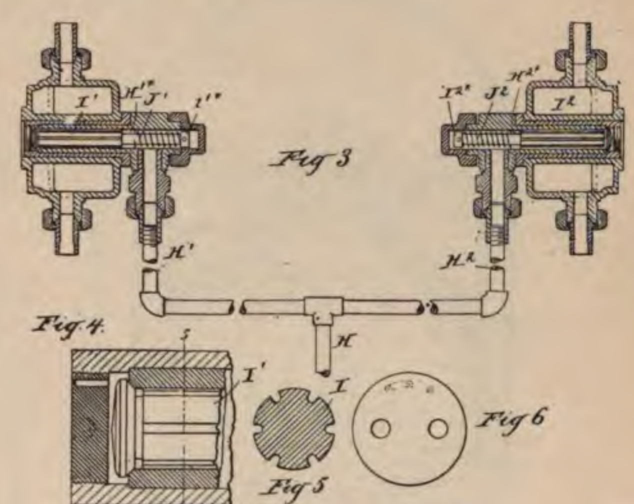
650,571—Gas or Oil Engine.—Hadwen Swain, of San Francisco, Cal. May 29, 1900. Application filed Aug. 5, 1898.




In this invention the inlet valve t is actuated by a bell crank lever, h, pivoted at i, and worked by a connection, j, to the reciprocating sleeve k. Inside this sleeve is a rod, e, worked by crank connection from the cam g, and it transmits its motion to the sleeve k by the wedge l. Both e and k are slotted so that there is some lost motion at the wedge; and the latter is connected to the governor (not shown), so that by shifting it up or down a greater or less opening is given to the inlet valve t, according to the speed of the engine. Fig. 5 shows a detail of the wedge. Ignition is effected by electric spark, and Fig. 4 shows the details of the arrangement. s is a finger on the outer end of the igniter stem, and the slide v, held down normally by a spring, is reciprocated back and forth by a suitable bracket, d d', on the end of e. In its motion toward the left it rides up on the latch b and snaps off from it, thus making a quick break spark. The stop pin f limits its downward motion, and latch b, being pivoted, swings down to permit the return of v.

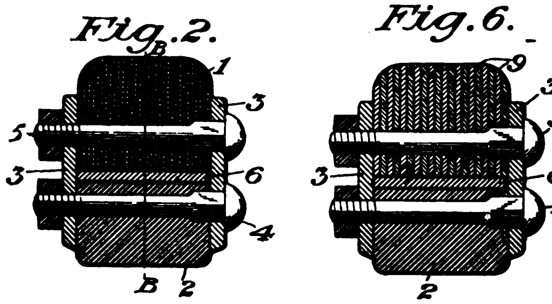
Three claims.

650,583—Explosive Engine.—Arthur H. Goldingham, of New York, N. Y., assignor to the De Le Vergne Refrigerating Machine Co., same place. May 29, 1900. Application filed Jan. 24, 1899.




This invention is for use in a two-cylinder gasoline or kerosene engine in which explosions occur one to every revolution, the suction stroke of one taking place simultaneously with the explosion stroke of the other. The fuel is injected directly into the combustion chamber on the suction stroke, and the inventor has found that in engines of this sort no special distributing mechanism is necessary, the pressure of the explosion being alone sufficient to prevent the fuel from entering the wrong cylinder. The fuel supply is therefore arranged as shown in Fig. 3, the oil being pumped in by the pipe H and going by branches H' or H² to one or the other cylinder. Check valves are interposed before the injection orifice is reached, these being of the form shown at I' and in detail in Fig. 4. The stem of the valve is made large and is grooved longitudinally, as shown in section in Fig. 5, and a spring closes the valve at the end of the oil pump's stroke. The pressure of the explosion keeps one valve closed while the other is free to admit the oil, which is then sprayed across the combustion chamber and vaporized by the heat of the latter.

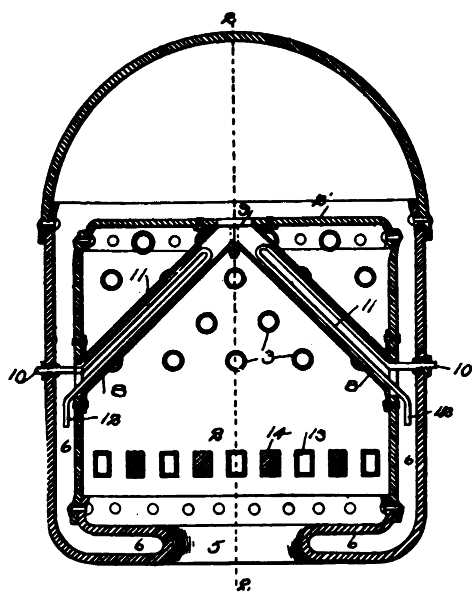
650,621—Vehicle Wheel Tire.—Arthur L. Stevens, of New York, N. Y. May 29, 1900. Application filed Nov. 3, 1899.




A tire of layers of fabric built up so as to present their edges to the ground, and vulcanized together with rubber. Figs. 2 and 6 show two arrangements for the purpose.

Eleven claims.

650,634—Steam Boiler.—C. W. Cox, of Sistersville, W. Va., assignor of one-half to G. A. Frampton, same place. May 29, 1900. Application filed Sept. 29, 1899.



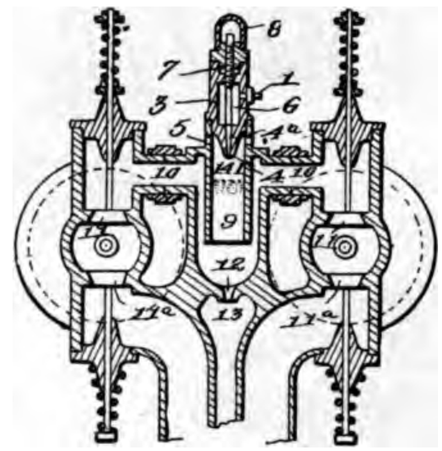
A boiler with both fire and water tubes, the fire tubes being arranged as in the locomotive boiler and the water tubes as shown at 11 11 in the figure, which is a cross section through the fire box. There is a row of these water tubes on each side of the fire box, and the feed water enters by tubes 10 10 and is heated before being discharged into the main body of water at 12 12.

Six claims.

650,736—Explosive Engine.—Henry Sutton, of Melbourne, Victoria. May 29, 1900. Application filed July 10, 1899.

In the figure 11a 11a are the exhaust valves, 11 11 the inlet valves and 4 is the nozzle by which the fuel is sprayed into the mixing chamber 9 and 10. The fuel enters at the nipple 1, and its normal level in the communicating cup or reservoir (not shown) is slightly below that of 1, so that it is drawn to the nozzle by the suction of the air in 9. Perforated plates or gauze are interposed at 141 to spread the fuel and prevent back explosions.

Two claims.



650,736. EXPLOSIVE ENGINE.

650,789—Gas Engine.—J. S. Losch, of Schuylkill Haven, Pa. May 29, 1900. Application filed Oct. 4, 1899.

This is a two-cycle gas engine, in which the forward end of the cylinder is used as a pump, and a tank, 11, is used to prevent excessive compression in the pump end. A rock shaft, 24, worked by a face cam (Fig. 8) running against a roller on the end of a lever arm at the forward end of the rock shaft, operates the igniter and uncovers the orifice admitting the liquid fuel to the air supply. Fig. 5 is a detail of 7 (Fig. 4). The air is drawn through the valve 8 and into the forward end of the cylinder by the port 6. On the out stroke of the piston the air passes through the valve 9 and is compressed into the reservoir 11, whence the uncovering of the exhaust port by the piston permits it to pass by way of the mixing chamber 12 and the ignition chamber 14 into the cylinder. In Fig. 6 is shown how the rocking of 24 in one direction, with quick return, operates the igniter 33 34, and how rocking it in the opposite direction opens the oil inlet 38. The engine is governed by reducing the admission of oil, which is effected by preventing the roller running on cam 19 from going into the depression 21, this being accomplished by a movable piece connected to the governor, and which passes through the aperture 19', so that when the speed increases the roller will ride on this movable piece instead of on the cam.

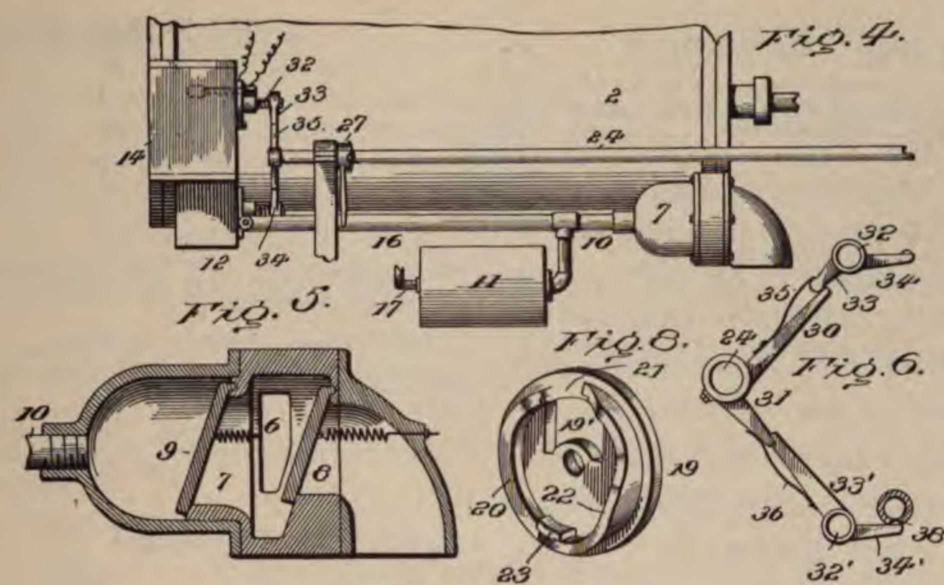
Six claims.

## BRITISH PATENTS.

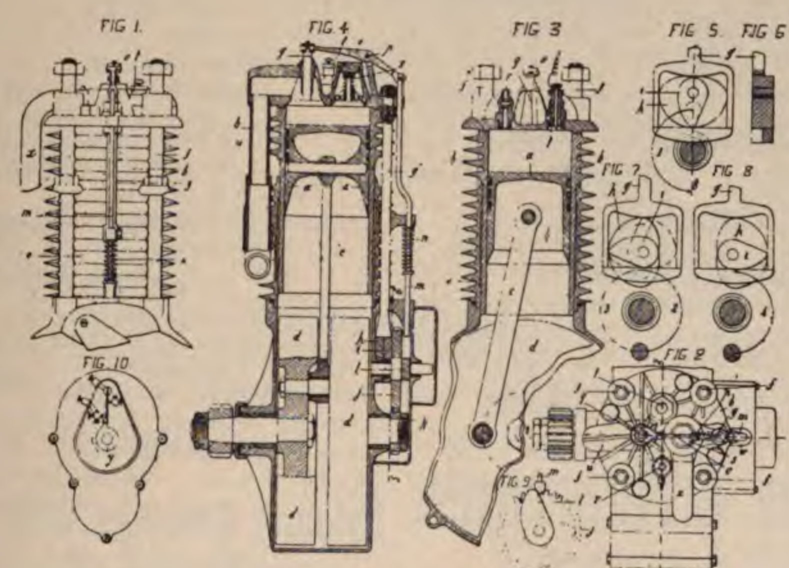
12,597—Explosion Motor.—G. A. Fleury, Paris. April 21, 1900.

This invention relates to an explosion engine, chiefly characterized by the employment of a movable cylinder enabling the volume of the explosive mixture in the explosion chamber to be increased, the complete discharge of the burnt gases to be effected, and increased power to be obtained.

Referring to our illustrations, Fig. 1 is an elevation and Fig. 2 a plan of the improved engine; Fig. 3 is a vertical section on line 1—2, Fig. 2; Fig. 4 is a vertical section on line 3—4, Fig. 2; Fig. 5 is a vertical section on line 5—6, Fig. 4, showing the position of the cams for acting on the



650,789. GAS ENGINE.



12,597. EXPLOSION MOTOR.

moving cylinder during the first or inhaling phase; Fig. 6 is a vertical section on line 7—8, Fig. 5; Fig. 7 shows the position of the cams during the second or compression phase and also during the third or explosion phase; Fig. 8 shows the position of the same cams during the fourth phase, at which the burnt gases are exhausted; Fig. 9 shows details of the cam which operates the exhaust valve through a rod and lever; Fig. 10 is a detail of the cam which produces the ignition contact. The same letters of reference denote like parts in all the figures.

The piston a works in the moving cylinder b and is connected by rod c with the crank pin of the fly wheels d, keyed on the driving shaft. Upon this shaft is a pinion, k (Fig. 4), which gears with a speed reducing wheel, j, whose axis carries a cam, l, which operates the exhaust valve q through the medium of a lever, o, pivoted at p, and rod m, moving in a guide, v, and pressed toward the cam by a spring, n. h and i are cams operated by wheel j, working within a frame attached to a rod, g, fixed to the moving cylinder b. The moving cylinder b is fitted to work within a stationary cylinder, e, and is suitably guided by means of rods, f, terminated by stop nuts, and upon its upper end are the compression cock r, the automatic inhaling valve s, the ignition device t, the telescopic exhaust pipe u for the gases and the suction pipe x connected to the carbureter by any suitable flexible pipe. The ignition cam y is keyed on the spindle of wheel j.

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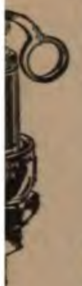

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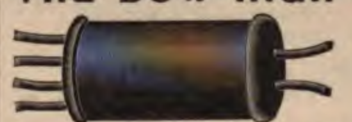

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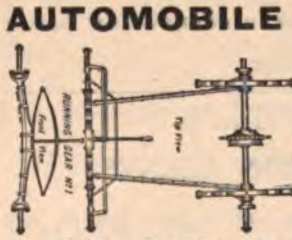

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# ACETYLENE MOTOR.. NUMBER

# JUNE 20.

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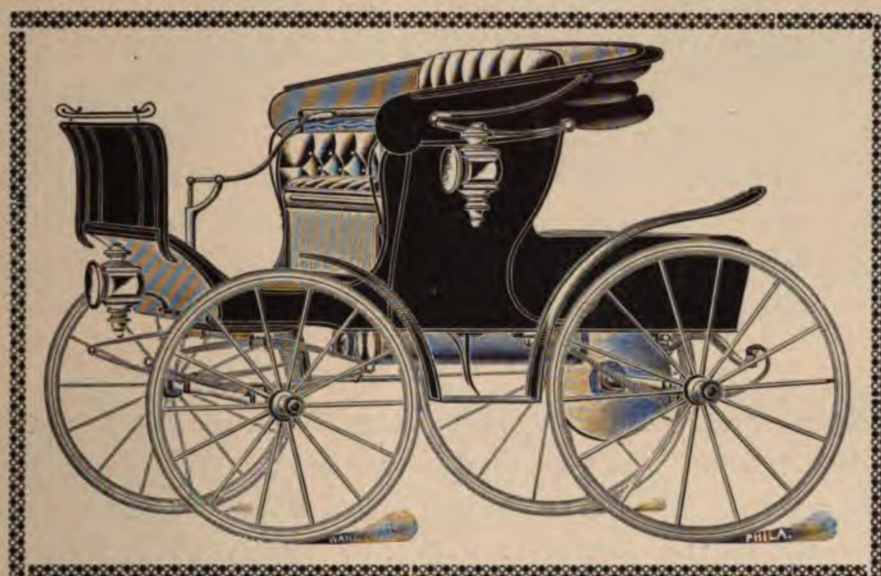

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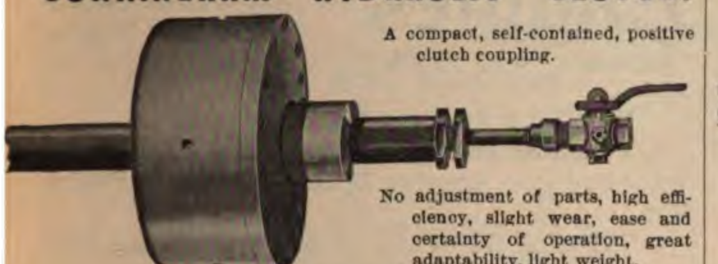

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# EXPLOSIVE MOTOR NUMBER

## JANUARY 17TH, 1900.

**LEADING ARTICLES....**

**The Hydrocarbon Engine as a Source of Energy**, by ELWOOD HAYNES.
**General Deductions**, by HENRY W. STRUSS.
**The Gasoline Engine Indicator Diagram**, by E. C. OLIVER.
**Vaporizers and Carbureters**, by HERBERT L. TOWLE.
**Ignition and Ignition Troubles**, by P. M. HELDT.
**Coils and Sparks**, by E. J. STODDARD.
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VOL. VI. NEW YORK, JUNE 20, 1900. No. 12.

## THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

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HERBERT LADD TOWLE, Associate Editor.

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## Acetylene's Prospects.

The price of gasoline might be materially above even its present high figure before the gasoline vehicle would begin to suffer in point of economy by comparison with its horse-drawn competitor. Unfortunately, there is at present no guarantee that such a level in its price may not be reached, or even exceeded. The increase in the number of gasoline motors of all sorts is steady and shows no sign of abatement. Probably the limit will soon be reached in the case of the larger gasoline engine for stationary work, both because the cost of running is the first thing here considered and because other fuels—illuminating gas, fuel gas and kerosene—are more readily substituted. But the motor vehicle industry is growing with astonishing rapidity, and not only will it more than make up for the destined falling off in the consumption of gasoline for stationary power, but nothing has yet been found in this field to take the place of gasoline. Doubtless new supplies will be found; but when we consider that for every gallon of gasoline produced 6 gallons of kerosene must be produced and also consumed, while the consumption of kerosene is stimulated much less than that of gasoline, we see that the equilibrium between the supply and demand of the latter fuel is an uncertain one, and is liable to lose rather than gain in stability.

Under these conditions it is evident that an efficient substitute for gasoline, which can be successfully applied on vehicles, would be most timely. The most obvious material for this purpose is of course kerosene. Kerosene is a much more difficult problem than gasoline, but it has been used successfully in stationary engines, and indeed is more commonly used than gasoline in England. There are also a few kerosene launch engines on the market, mostly English; but so far as we recall there are but two demonstrably successful kerosene explosion motors for vehicles now manufactured, one being French and the other English. We do not believe that this is likely to be the case very long, as the logic of the situation points plainly to the increased use of the cheaper fuel; but until kerosene has made an established place for itself it is not unreasonable to investigate further for other possible substitutes.

Among these possibilities the gas acetylene seems to claim first place, from its extraordinary heating power and the comparative ease of its production; and already experiments of various sorts have been made with a view to learning its capabilities. Much valuable information has been gathered regarding its properties, physical and chemical, and some tests have been made of explosion motors burning this gas as fuel. It must be admitted that the latter tests have been crude. Ordinary gas or gasoline engines were used, with no change except to reduce the fuel supply, whereas the known properties of acetylene make it evident that the best results are to be obtained only by the use of a motor designed with reference to its peculiarities. But enough has been learned to afford a valuable guide for further work, and to indicate that the development of a successful acetylene motor is quite within the bounds of engineering possibility.

The characteristic action of acetylene mixtures in a gas engine cylinder has been touched upon at length by our contributors and need not be dwelt upon here. One central fact to be borne in mind is that acetylene, unlike other gas engine fuels, will decompose spontaneously into its elements under the combined influence of heat and pressure. Not only is this true of the pure gas, but the same phenomenon appears with mixtures in which the acetylene is largely in excess. Prof. Vivian B. Lewes found that a mixture of equal parts of acetylene and air at atmospheric pressure exploded with a pressure of 20 atmospheres, or about double that reached by a normal mixture of 1 to 12. This indicated that the mixture burned with increasing heat and pressure up to a certain point, and that then the excess of acetylene detonated and added its heat of decomposition to that of the combustion. It seems probable that explosion of the mixture in an engine cylinder is always preceded or accompanied by decomposition of the acetylene; and it is very certain that unless enough oxygen is present for the complete combustion of both the hydrogen and the carbon the latter will be deposited or condensed on the cylinder walls, head and valves, to the speedy stoppage of the engine. It would appear that an excess of air is always necessary to prevent this.

The power developed by an ordinary gas engine using acetylene gas does not differ greatly from that developed by the same engine using oil gas; but the volume of acetylene used will be only about one-third the volume of oil gas. Cuinat tested a 6 h.p. engine, using first water gas and then acetylene. The engine was arranged to admit both gas and air for the first two-thirds of the suction stroke, then air alone for the rest of the stroke, finally to expel the air through the suction valve, whose closing was delayed for that purpose. In that way a longer expansion than the ordinary was obtained, and the terminal pressure was about half what it would otherwise have been.

The first tests were made with oil gas, and the consumption was as follows per brake horse-power hour:

| | |
|---|---|
| Half load, 3 b.h.p. | 30.93 cu. ft. |
| Full load, 6 b.h.p. | 18.22 cu. ft. |

Diagrams showed that the compression was 87.6 lbs. per sq. in., the maximum pressure 243.8 lbs., and the terminal pressure 45 lbs.

The next tests were with acetylene, in the approximate proportion of 1 to 20. The consumption was, per brake horse-power hour:

| | |
|---|---|
| Half load, 3 b.h.p. | 10.66 cu. ft. |
| Full load, 6 b.h.p. | 6.17 cu. ft. |

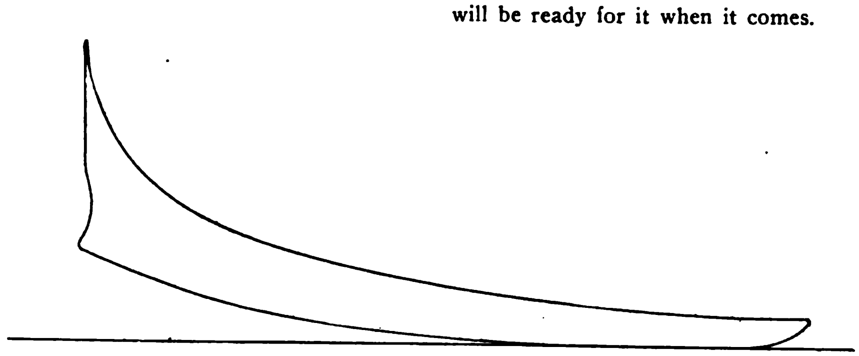
The compression was 25.5 lbs. higher, which was ascribed to the higher temperature of the walls; the maximum pressure was 412 lbs., but the terminal pressure was 13 lbs. less. A larger quantity of jacket water was needed, being about 35 gals. per hour.

The extremely rapid combustion, more nearly "explosive" than in any other of the "explosion" engines so-called, and its resulting immediate and great loss of heat to the water jacket, have been remarked by all experimenters with acetylene in motors. There is no question of its injurious effect on the economy of the engine, and it is likewise objectionable for the severe and useless stresses imposed on the working parts. It would seem evident that the compression in an acetylene motor should be very materially less than for gasoline or gas, and we venture the opinion that important results may be secured by proper attention to this point.

## The Result of the Race.

The result of the race for the Gordon Bennett Cup will not come as a surprise to those who have followed the development and performances of the French racing machines. A long and strenuous rivalry between builders of world-wide renown, with chauffeurs who fear absolutely nothing, has evolved a breed of men and machines the like of which, we suppose, cannot be matched outside of France. American builders, confronted by the much more practical problem of negotiating American bad roads, have given little attention to the subject of extreme speed on a level track. Probably Mr. Winton himself did not expect to win.

Nevertheless, the time made by the American champion before his machine was disabled was unexpectedly good; and when such a giant of the *course* as René de Knyff withdraws on account of a breakdown it is no shame to be in his company. The next race will come in due time, and America will be ready for it when it comes.



ACETYLENE INDICATOR DIAGRAM.

# Acetylene and Alcohol Versus Gasoline As Fuels.

By Isaiah L. Roberts.

The choice of any fuel for use in the arts of man depends on the purpose for which it is to be used, regardless of its first cost or comparative thermic value per unit of weight. For instance, coal or coke is generally used as a fuel for generating heat to melt iron, but it has been proven that powdered aluminum can be more advantageously used to melt iron in a small crucible in a few seconds just when and where it is needed, notwithstanding it costs per heat unit more than one hundred times the price of coke. Magnesium is one of the most expensive of all fuels, but it will make a quick fire and light by which a photograph or signal may be produced cheaper than with commercial oil. Therefore, in choosing a fuel we must take into consideration all the conditions under which it is to be used for accomplishing the object sought.

This article will be confined to a comparison of the value of petroleum, acetylene and alcohol as fuels for use in the propulsion of self-moving vehicles by explosion in the cylinders of their engines, and not as a fuel to generate steam. However, from the data here given the reader will see that where steam is to be generated the choice of one of the three above mentioned must rest on the one which will yield the greatest number of heat units for a unit of cost of a unit of weight, as well with a steam generator as with an explosive motor, where all are of equal convenience.

The amount of heat generated by the combustion of any substance in oxygen has been accurately ascertained by many independent investigators by actual experiment and test. Among these may be mentioned Andrews, Favre and Silberman, Julius Thompson and Berthelot and others; hence there is no longer any question about the facts here set forth.

All the value of the above fuels depends solely on the amount of hydrogen and carbon they contain, and as above stated, each one of these substances yields a known amount of heat per unit of weight; therefore, if we take as a unit a gram, kilogram or pound, we can state just how many heat units will be evolved by the combustion of that unit in air, which is only oxygen diluted with nitrogen in the proportion of about 23 parts of oxygen to 77 of nitrogen, and this is the uniform proportion the world over, regardless of altitude. While the nitrogen is a neutral substance and does not enter into chemical combination with any of the products of combustion, it nevertheless serves a very important part in the propulsion of the piston in the cylinder of an explosive engine. It absorbs the heat at the moment of combustion and yields it up in work by expanding as the piston moves. It is not necessary to go into further details on this point in this article, as the reader will find this subject fully worked out in the great works of Maxwell, Carnot and others.

Having before us the wonderful works of those patient and beneficent men above mentioned, we can now determine beforehand what the value of a fuel is by simply knowing its chemical composition.

In the examination of the three substances, viz., petroleum, acetylene and alcohol, we will proceed in the order named. On examination of the chemical composition of the petroleum series we find it is made up by the addition to each other of the hydrocarbon radical $CH_2$ to the foundation one called methane, $CH_4$. This addition was performed by nature in the interior of the earth in some past age in a manner not yet clearly understood. Most of the groups of this hydrocarbon have been studied and named chemically and somewhat roughly commercially, but we cannot go extensively into the composition of all of them here. It is sufficient to say that the first three are gases which have the formula $CH_4$ methane, $C_2H_6$ ethane and $C_3H_8$ propane in various and ever varying proportions, and compose what is known as "natural gas." The next three groups, when mixed, as they always are in the distillation of crude petroleum, are called in the trade "gasoline." These have the formulas $C_4H_{10}$ butane, $C_5H_{12}$ pentane, $C_6H_{14}$ hexane. Butane boils at 1 deg. C, pentane 38 and hexane 70. The next two or three are called in the trade, "kerosene."

The operator of gasoline motors finds in the case of automobiles when using only a cool carbureter that toward the last of the run there remains an oil that will not volatilize sufficiently to enrich the air in the cylinder to that degree necessary for an explosion. The reason of this is that the gasoline of commerce, unless especially distilled for that purpose, contains a considerable percent of heptane, $C_7H_{16}$, and some octane, $C_8H_{18}$, or, in other words, kerosene. Still higher comes the heavy oils, and finally paraffine wax, and even tar, all of which have names, and are built up by the continually advancing addition of $CH_2$.

Acetylene, on the other hand, is also a true hydrocarbon, but has the uniform formula of $C_2H_2$, while the alcohols are oxygen derivatives of the hydrocarbons mentioned above. Therefore we have from methane, $CH_4$, methyl alcohol, $CH_4O$, or wood alcohol, and from ethane, $C_2H_6$, ethyl alcohol, $C_2H_6O$, or common spirits of wine, and chemically we can produce propyl alcohol, $C_3H_8O$, from propane, $C_3H_8$, and so on with the rest of these hydrocarbons; but they are too expensive to be used as fuels when compared to ethyl and methyl alcohols. It will be seen from the foregoing that we have just two elements for fuel out of all this array of formula and nomenclature, viz., hydrogen symbol H and carbon symbol C. Now, the exact amount of heat produced by the combustion of each of these per unit of weight as aforesaid is well known, so that it does not matter how these elements cling about each other in their molecular formation, nor what name these different groupings have, or how differently they taste or smell; when oxygen comes courting they all break up their weak union with each other and rush to form a new union with it, which will be more stable, and in so doing each gram or kilogram of hydrogen yields 34.562 heat units, or in other words will raise the temperature of 34.462 grams or kilograms of water 1 deg. C.; or, if one gram be burned, it will raise the temperature of 34.462 grams of water 1 deg. C.; hence we say that one unit of hydrogen burned has 34.462 heat units, and so on with any substance whatever, according to the strength of its affinity for oxygen. Carbon yields on burning in oxygen, when forming $CO_2$, about 8,000 heat units.

Now, from these known data it is easy to figure out the heat units that are contained in a pound or kilogram of $CH_2$, which is the general formula for petroleum compounds, commonly called in the trade rigoline, benzine, gasoline, kerosene, etc.

I prefer to use the kilogram and gram in the calculations here, because they are the standard units now used all over the world in chemical calculations. The kilogram is about 2.2 lbs. and a gram is one-thousandth part of a kilogram.

Now, if we take a kilogram of gasoline, which will be nearest represented by hexane, $C_6 H_{14}$, although the other two are present, it will be seen that it does not materially alter the calculation if we took pentane, $C_5 H_{12}$; but as the former predominates in ordinary gasoline, it will be the basis of our calculations.

Now, as the atomic weight of carbon is about 12 and hydrogen about 1, we have 72 grams of the former and 14 of the latter in 86 grams of hexane. Therefore we have 837.2088+ grams of carbon and 162.7906+ grams of hydrogen in 1,000 grams, or one kilogram. If we multiply the carbon grams by 8,000, the heat units of carbon, and the hydrogen by 34.462, the heat unit of hydrogen, we have 6,697,670.4+ grams heat units for the former and 5,610,413.6+ for the latter, or 12,308,083+ total for both per kilogram.

The formula of acetylene being $C_2 H_2$, there is in one kilogram of that gas 923.04+ grams of carbon, which has 7,384,320+ heat units, and 76.92+ grams of hydrogen, which has 2,650,817+, or a total of 10,035,137+ heat units.

The formula of wood alcohol, $CH_4 O$, will be used for our calculation, as ethyl alcohol, or spirit of wine, is so taxed by the Government that it cannot be used as a fuel, and if it could be it would not have any more heat units than methyl, as will be seen by figuring from its formula, $C_2 H_6 O$.

In calculating the heat units of alcohol, we must begin by throwing out of the formula the $H_2 O$, water, because alcohol is really only the radical, $CH_2$, combined with a molecule of water by fermentation in nature or synthesis in the arts. Therefore we must add, as above, this water in order to get the total weight, and then deduct it. Thus, $CH_2 + H_2 O$, or carbon 12, hydrogen 2; then hydrogen again in the water, 2, and oxygen 16. This gives us 32 as the divisor of 1,000 grams and shows more than half of our alcohol is water, as C and $H_2$ equal 14 parts, while the $H_2$ added 16 of oxygen equals 18 parts. Therefore, the available carbon in a kilogram of alcohol is 374.616 grams, which, multiplied by 8,000, gives us 2,996,928+. The available hydrogen is 62.436 × 34.462 = 2,151,669.432+, or total for both of 5,148,597.432+.

This, however, is too favorable a showing for alcohol, even if pure, which it never is in commerce. It always contains a percentage of water; besides, we must deduct the heat units that are lost in the evaporation of the 561.824+ grams of water; but in this article we cannot go into the question of latent heat, which is, however, nearly the same for all the hydrocarbons, but the water of combination in the alcohol is a distinct loss over that of mere combustion, and is considerable.

In summing up the situation we must take into consideration the cost of a kilo of the substances mentioned, which are of course subject to fluctuations in the market. Gasoline can be purchased by the small consumer at about 5 cents per kilogram, while acetylene must be generated from carbide of calcium, which will probably cost 10 cents per kilogram to the small consumer, in cans, and as the average carbide will not run over 10 cu. ft. of acetylene to the kilogram, and as roughly about 30 cu. ft. weighs a kilogram, we need 3 kilograms of carbide, which will cost about 30 cents. Alcohol can be obtained at about 40 cents per kilogram. Having all this data at hand, we can make the comparison of cost as fuel of the three substances named above:

Gasoline, per kilogram, 5 cents; heat units, 12,308,083.+.
Acetylene, per kilogram, 30 cents; heat units, 10,035,137.+.
Alcohol, per kilogram, 40 cents; heat units, 5,148,597.+.

It would seem from the above figures that we must look to petroleum for some time to come for a source of heat if the price is to determine our choice.

# Acetylene and Its Adaptability as a Motive Power for Vehicles.

By E. C. Oliver, Instructor in Mechanical Engineering Laboratory, University of Illinois.

Acetylene was first isolated by Prof. Edmund Davy in 1836, who found that in the production of potassium from potassium carbonate a small by-product of potassium and carbon remained which decomposed on the addition of water, giving acetylene. This gas he called klumene, and described it as an odorous combustible gaseous bicarburet of hydrogen. The by-product from which this was obtained was shown by Berzelius in the same year to be potassium carbide.

Considerable interest was again drawn to the gas between 1859 and 1866 by the investigations of Berthelot and Wöhler. The former obtained acetylene by the decomposition of sodium carbide produced by forming and then heating sodium acetylide. He also showed in 1866 that acetylene is formed by the electric arc in an atmosphere of hydrogen, affording the first example of the direct synthesis of a hydrocarbon. In addition to thus preparing the gas, Berthelot investigated its physical properties.

To Wöhler belongs the credit of having first obtained calcium carbide, as he formed this substance by heating to a welding temperature an alloy of zinc and calcium with carbon, and from this calcium carbide he obtained acetylene by decomposition with water, thus:

$$Ca + C_2 = Ca\,C_2$$
$$Ca\,C_2 + H_2\,O = Ca\,O + C_2\,H_2$$

The former reaction is of the greatest importance, and is entirely due to the influence of heat.

In 1880 Dr. Borcher, while conducting some experiments in a small electric furnace, found that calcium carbide was formed by the action of calcium vapor from the quicklime lining on the carbon electrodes. After a complete study of the carbides he gave a full account of calcium carbide and its reactions in 1894, when he exhibited crystals of the carbide obtained from pure quicklime and carbon made from sugar.

At the same time T. L. Willson, at Spray, independently discovered that calcium carbide could be obtained in an electric furnace. He was endeavoring to obtain alloys of calcium, and discarded the dark product obtained, which, it was noticed, effervesced upon coming in contact with water. It was then found that calcium carbide had been produced, which upon decomposition gave acetylene.

Until this time the production of calcium carbide and acetylene had no commercial importance, owing to the high price of calcium. It was of use mostly for a study of its chemical reactions; but when the advent of the electrical furnace made possible its production in large quantities and at a comparatively low price more attention was given to adapting it to the uses for which it was suited.

### MANUFACTURE.

Calcium carbide is manufactured on a commercial scale by heating lime and carbon in an electric furnace. This furnace consists in principle of a cast iron crucible forming one electrode and containing the mixture and a number of carbon pencils forming the other electrode. The carbon electrode is adjustable that it may be fed into the mixture as it is burned up, and the voltage kept constant. Ground coke is used as the carbonaceous material, and it is intimately mixed with finely ground unslacked lime in a proportion of 100 parts of lime to from 63 to 67 parts of coke, the percentage of coke

varying with the voltage used. The current may be either alternating or direct, as the action is one of heat and not electrolysis. The voltage used varies from 65 to 100, and the current from 1,700 to 2,000 amperes.

One horse-power hour is required to produce .3 of a pound of carbide of good quality, or about 7,000 h.p. hours per ton. The great power necessary has led to calcium carbide being produced only when there is abundant water power, as at Niagara. The cost of a horse-power at this place is about $18 per electrical horse-power per year, and at this rate calcium carbide may be purchased in large quantities at from $75 to $80 per ton.

#### PROPERTIES OF CALCIUM CARBIDE.

Calcium carbide is a hard crystalline substance of a reddish brown color when pure, but owing to impurities the commercial article is of a gray or brownish black color. It has a specific gravity of 2.262.

Theoretically, 1 lb. of carbide should require .525 lb. of water for its decomposition, and give 1.1563 lbs. of lime and .4064 lb. of acetylene, measuring 5.903 cu. ft. at 60 deg. F. and atmospheric pressure; but it has been found more economical to manufacture a carbide giving about 5 cu. ft. of gas per pound.

Upon decomposition 1 lb. of calcium carbide gives out 900 British thermal units, and this heat must be taken into careful consideration when devising generating apparatus, owing to the low temperature at which acetylene is decomposed, and also in order that the impurities contained therein (sulphureted and phosphoreted hydrogen and ammonia) may not be volatilized and contaminate the gas produced.

#### GENERATING APPARATUS.

The various types of generators used may be divided into classes as follows: those in which the carbide and water are brought into contact with each other by the change of level of one of the substances; those in which the water is allowed to fall on the carbide drop by drop or in small quantities, and those in which the carbide is added bit by bit to a large quantity of water. These classes may be also divided into those generators which act automatically and those which depend on the operator for manipulation.

Of each class there are a number of forms made, but the most promising perhaps is the last mentioned class, for in this the large body of water will most effectually take up the heat generated, besides absorbing to some extent the impurities given off.

#### STORING ACETYLENE.

There are three general ways in which acetylene may be stored: (1) By keeping it latent in calcium carbide and generating it as needed. This method has the advantage of safety and convenience in handling, but there is sometimes considerable loss due to the after generation of the gas, unless there be means used to store this gas for future use, which may not always be possible.

(2) Acetylene may be liquefied at 97 degs. F. by a pressure of 68 atmospheres, or at 68 degs. F. by a pressure of 42.8 atmospheres. In this state one volume of liquid acetylene will produce 340 volumes of free gas. It is the lightest liquid known, having a specific gravity of .4, water being 1, and has also the greatest coefficient of expansion known for any liquid or solid, one volume at 32 degs. F. expanding to 1.24 volumes at 96 degs. F. In addition to these properties, liquid acetylene may be fired by a spark or incandescent wire, and then has all the characteristics of a modern explosive.

Under these conditions then it may be said that although when carefully handled acetylene may be stored in this manner, yet it does not offer sufficient promise to make it popular.

(3) At 59 degs. and atmospheric pressure, acetone ($C_3H_6O$) is capable of absorbing twenty-five times its volume of the gas, and this property of taking acetylene into solution rises nearly in proportion to the pressure between 32 and 95 degs. F. At 12 atmospheres 1 volume of acetone absorbs 300 volumes of acetylene, and the consequent volume is 1.48 at this pressure.

Messrs. Berthelot and Vieille, who have made investigations concerning this mixture, found that when the pressure did not exceed 28 lbs. per square inch and the temperature 60 degs., a cylinder containing acetone saturated with acetylene was not exploded even with a fulminate cap. From this pressure up to a pressure of 142 lbs. per square inch, the mixture was explosive, but the pressure of explosion was not greater than that of pure acetylene under the same conditions.

This field probably offers the most promise of any method now known of storing the gas. It is possible to carry a considerable supply without an especially weighty reservoir, and it is practically safe.

#### EXPLOSIVE PROPERTIES.

Acetylene and air at atmospheric pressure will burn when mixed in any proportions between 2.7 per cent. and 95 per cent. of acetylene, while between 4 per cent. and 67 per cent. an explosion takes place, being most violent when there is about 8 per cent. of acetylene present.

Acetylene alone will not explode until the pressure is increased to 1 1-20 atmospheres, but above this pressure it is violently explosive; consequently, it should not be kept under a pressure of more than a few inches of water.

The results of a series of experiments made to ascertain the maximum pressure of explosion of this gas under various pressures are given in the following table:

Pressure in Atmospheres.

| Initial. | After explosion. |
|---|---|
| 2.15 | 8.50 : 10.44 |
| 3.38 | 18.00 : 18.71 |
| 5.78 | 40.04 : 42.03 |
| 10.87 | 89.76 : 88.80 |
| 20.45 | 206.77 : 205.70 |

For its mixtures with air in varying proportions, Grehant has made numerous experiments, the results of which he states in the following table, and which are for atmospheric pressure:

Acetylene 1, air 1—Burns with sooty flame.
Acetylene 1, air 2—Burns with sooty flame.
Acetylene 1, air 3—Explosion with sooty deposit.
Acetylene 1, air 4—Explosion without sooty deposit.
Acetylene 1, air 6—Strong explosion.
Acetylene 1, air 9—Strongest explosion.
Acetylene 1, air 12—Strong explosion.
Acetylene 1, air 19—Weak explosion.
Acetylene 1, air 20—Inflammation without explosion.
Acetylene 1, air 25—Inflammation without explosion.

In a recent paper by M. Ravel he states that the temperature required to explode this gas is but 900 degs. F., whereas it requires 1,100 degs. F. to explode any mixture of coal gas and air; also, that the temperature of explosion reached 7,200 degs. F.

#### ITS USE IN MOTORS.

Authorities differ regarding the expediency of using acetylene in motors, and numerous experiments have been carried out, with varying results, to determine its usefulness.

A report in La Revue Industrielle of some tests made by Cunat with engines of from 8 to 16 h. p. states that acetylene was used in these engines with no other change than to diminish the size of the inlet valve, and that when used in a mixture of 10 of air to 1 of gas, acetylene gave three times the energy of an equal volume of coal gas, developing a horse-power for 6 cents per hour.

M. Ravel with a 2-h.p. motor was able to obtain a horse-power hour on 6.35 cu. ft. of acetylene, using a mixture of 15 air to 1 of gas. This gave about 2.1 times the energy of coal gas. In another engine he could not use a greater proportion of gas than 5 per cent., due to the high compression, and noted that while the explosion pressure was extremely great, yet the fall of pressure was immediate and expansion was not carried out.

These experiments are of value to us as they point out some of the difficulties in using acetylene as a motive power, and also suggest some improvements which might be made in the design of motors intended for the more effective and economical use of this gas.

The following points regarding the behavior of the gas need to be especially noted: (1) The low ignition temperature. (2) The great rapidity of the transmission of flame. (3) The high combustion temperature. (4) The extraordinary energy evolved by the explosion. (5) The wide range of its explosive mixtures.

A motor designed for the use of this gas should be built with the object of eliminating as far as possible the ill effects due to these characteristics without impairing the properties which may be of value in the economical working of the machine.

It is evident from the foregoing that to avoid premature explosions the cylinder must be kept at a temperature lower than the ignition temperature of the mixture when compressed. This would necessitate a water jacketed cylinder even in small sizes on account of the extremely high temperature of the combustion. On the other hand, the low temperature of the cylinder walls would greatly lessen the effective pressure of expansion, as the cooling effect of the walls on the gas would be very marked. It would, however, be impossible to avoid this action. The only way to increase the efficiency would be to increase the speed of rotation, this giving less time for an exchange of heat between the gas and cylinder walls.

The increased shock on the parts of the engine due to the greater pressure of explosion would necessitate greater area of bearing surface at each end of the connecting rod and in the main bearings of the engine shaft, as well as a stiffer construction throughout. This would, however, be partially arranged for by giving the engine less pressure of compression by increasing the per cent. of clearance or by other means, thereby lessening the force of explosion and consequent shock on the parts.

The great range of explosive mixtures would lend itself very readily to the control of the speed of the motor by an adjustment of the supply of gas.

That acetylene may be used as a motive power is assured, but whether it will prove popular cannot at present be stated. It has many of the desirable qualities of gasoline, but at present is more expensive, and the motor in which it is used would probably be subject to more wear and consequently more repair than if used with its milder rival.

The acetylene motor must necessarily spend a considerable time in the experimental stage, and with the knowledge gained from other explosive motors it is not unlikely that one may be built which will prove not only successful but popular.

# Will Acetylene Be the Coming Power for Motor Vehicles?

By D. N. Long.

Of the various motors now used in horseless vehicles, it is true that none are giving complete satisfaction, from the fact that they are not yet properly adapted to the work required. In the competitive race of the different forms of motors for autocars, electricity can only be considered for use in towns where recharging can conveniently be done, leaving the field for the general purpose carriage to possibly either the steam or the gas engine. Recent improvements in the automatic feeding of water to the steam boiler without the use of either the troublesome pump or the injector, and the convenient raising of a working pressure of steam in a few moments of time, will go far toward making steam a successful rival of the gas or gasoline engine.

The gasoline engine is probably on the whole the most popular motor for this line of work, at present, and whether the test of experience will cause it to be superseded by steam or any other form of power is a very interesting question to the millions who are directly interested in the horseless vehicle question. Outside of steam, the only competitor of gasoline for a general purpose conveyance that well-informed scientists and mechanics look upon as likely to be superior is the interesting new illuminant, acetylene, which is revolutionizing the present methods of artificial lighting in nearly every line. It is now conceded that acetylene has advantages for power purposes that may cause it to revolutionize the present methods of producing power as it is now revolutionizing methods of lighting, and at the request of The Horseless Age I herewith submit the principal points of advantage thus far demonstrated.

As the result of nearly five years of almost constant and very successful work in the difficult problems surrounding the question of producing acetylene for lighting purposes, I have had exceptional opportunities for becoming informed of its adaptability for power purposes, and am satisfied that some of the principles involved in the more recent generators for lighting purposes will do much toward adapting it for the successful production of power. I refer particularly to a newly developed feature whereby acetylene can be automatically produced under any degree of pressure that may be desired.

By Europeans, especially in France, much more work has been done toward using acetylene for power than in this country, and in an excellent work on "Petroleum Motor Cars," by Louis Lockert, some of the following very significant facts are set forth: He claims that acetylene seems marvelously adapted to solve the problem of auto-locomotion, for the reason that 1 lb. of calcium carbine, when combined with 9 oz. of water, gives 34 gals. of acetylene, representing energy two and one-half times as great as that of coal gas, showing that with 22 lbs. of carbide a motor of 1 h.p. can be run for 10 hours. Gasoline alone can compete with this wonderful product as regards the dead weight to be carried. Among the principal points of advantage in acetylene over gasoline is its large range of explosive mixture with air, being roughly from 1 part of acetylene to 1 of air, to 1 of acetylene to 25 parts of air; while with gasoline the mixture should be very close to 1 to 9 to secure good results and perfect combustion, a condition not always easy to fully control in view of the varying temperatures of the surrounding air, and many other contingencies.

Again, acetylene can be produced and satisfactorily used at almost any temperature, while gasoline requires heating in cold weather. The comparatively low temperature of acetylene inflammation insures perfect efficiency of the electric spark for igniting purposes. Acetylene affords the best known headlight, which can be supplied from the same generator which produces gas for power. It has also great velocity of flame propagation and absence of offensive odor of the exhaust.

M. Le Chatelier has made various experiments on mixtures of air and acetylene, from which he has inferred, as V. B. Lewes had before him, that a mixture of 1.25 parts of acetylene and 1 part of air commences to be explosive, that the explosive force increases as the admixture of air is increased, that the maximum is obtained with 12 parts of air to 1 of acetylene, and that beyond this ratio the explosive force decreases, the compound nearly ceasing to be explosive when the proportion of 25 volumes of air to 1 of acetylene is reached.

The velocity of propagation of the flame is said to be 0.18 meter (7 in.) per second for a mixture of 2.9 parts to 100 of air; with 6 to 100 the velocity is 5 meters (16 ft. 5 in.), and 10 to 100 it is 6 meters (19 ft. 8 in.), which is the maximum limit. The temperature of inflammation (flashing point) is somewhere about 480 degs. C.—that is to say, much lower than in the case of other inflammable gases, for most of which it is 600 degs. C. Explosive mixtures of acetylene, inclosed in glass tubes, may very readily be ignited by heating the tubes for a few moments over a spirit lamp; the explosion ensues a good time before the softening of the glass. The temperature of combustion is much higher than for any other gas; burnt with an equal volume of oxygen it would yield a temperature of about 4,000 degs. C.—that is to say, 1,000 degs. more than for the oxyhydrogen compound, which is the hottest known flame outside of acetylene.

In fine, acetylene, according to these observations, may be said to present the following properties:

1. Great velocity in the propagation of the flame.
2. Very low temperature of inflammation.
3. Very high temperature of combustion.
4. Extraordinary energy of explosion.

A comparison between coke and carburet, or carbide of calcium, with regard to the respective weights and volumes of the supplies required for working any autocar for a given period, shows:

1. Coke. The "Serpollet" system consumes 4½ lbs. of coke per horse-power per hour, or for 100 hours and for 10 h.p. over 2 tons of coke, which would occupy a volume of about 140 cu. ft.

2. Carburet or Carbide of Calcium. Assuming 2¼ lbs. per hour of carburet of calcium to suffice for the production of 2 h.p., the quantity required for developing 10 h.p., during 100 hours, would be 10 cwt., which could be stowed in a space of 66 gals., or less than 10 cu. ft.

Carburet of calcium is, apart from petroleum, the only source of motive power that would have enabled an autocar to cover the distance from Paris and back (1,200 kilograms = 745 miles), while carrying with it the whole store of energy required for the journey. Acetylene, on the other hand, seems preferable, if we consider the cleanliness of its manipulation, the impossibility of accidents through catching fire, and the absence of bad smells from the exhaust. Acetylene was tried for the first time in a detonating motor by Pierre Ravel. In this system ignition is effected by the electric spark, which alone permits of regulating the moment of ignition to a nicety. The motor used by M. Ravel was one of his own worked by M. Houpied, manager of the Compagnie des Moteurs Parisien.

M. Ravel after every trial with ordinary gas made a corresponding trial with acetylene, and he took diagrams of each.

M. Ravel in the first place recorded several general observations:

1. The usual lubrication of the cylinder when working with coal gas had to be doubled when working with acetylene gas.

2. The degree of cooling of the cylinder exerts a greater influence on the work done than when the cylinder works with coal gas.

The initial pressure increases with the volume of the doses of acetylene, but an inspection of the diagrams shows that the falling off of the pressure is immediate; the expansion is not sustained. They also show that when the proportion of acetylene approached 5 per cent., the explosions become violent. M. Ravel concluded from these experiments that 1 liter of acetylene will produce on the piston of a motor of the 2-h.p. type an effort equal to 820 to 870 indicated kilogrammeters (5,930 foot-pounds to 6,290 foot-pounds).

M. Ravel does not believe that the great explosive force of acetylene could produce its full useful effect on the pistons of detonating gas motors, as they are constructed at present. This conclusion is one that the writer cannot but indorse, more especially as regards the propulsion of autocars, since for a long time past he has been convinced that the builders of horseless cars driven by detonating motors are on the wrong track.

Hence the advancement of the question can only gain by the study of absolutely new systems of motors, which being specially suited for utilizing the explosive properties of acetylene, will also be able to give better results with compounds of ordinary coal gas or petroleum vapors.

An ideal motor for acetylene would seem to be one in which the great explosive force of acetylene can be utilized, which may probably be better accomplished by some form of rotary engine than by the regular reciprocating gas engine now in use. By having a supply of acetylene under any desired pressure, acetylene could perhaps be mixed with air by means of such pressure, and sufficient pressure retained in the mixture to force it into the exploding chamber, which would point toward more frequent explosions than is practicable with gasoline.

The fact that acetylene will produce perfect combustion over so large a range of air mixtures is a point much in its favor, as this will do away with the troublesome question of the formation of soot, which is frequently a serious obstacle in the use of gasoline.

Taking Lockert's assumption of 2¼ lbs. of carbide for 2 h.p. to be correct—which, however, is doubtless too little—the weight of carbide with the necessary water would be little more than 1½ times the weight of gasoline, figuring 1 pint of gasoline per horse-power; while the expense, figuring gasoline at 2 cents per pint and carbide at 4 cents per pound, would be about twice as much for the carbide or acetylene. However, the price of carbide is steadily falling, while all petroleum products are on the rise, and as under favorable circumstances carbide can be made, it is claimed, for 1½ cents per pound, it may in the near future be a cheaper source of power than gasoline.

The field for the use of alcohol, unless made cheaply from acetylene, would seem to be prohibited, except for very special uses, by its excessive cost.

## On Some French Experiments on Acetylene and Alcohol as Motor Fuels.

By P. M. Heldt.

In the United States gasoline is a household article, which can be bought at every country store, and at a comparatively low price. The conditions under which it is sold in European countries are rather different. The high price at which it sells there has prevented the generalization of its use, and the places at which it is sold are therefore relatively few and far between.

In Germany, where it goes under the name of benzine, it is generally bought at drug stores. In France the large development of automobilism, and especially the development of automobile country touring, has caused the establishment of many repair shops and supply depots along the main highways, where gasoline can be bought in cans of 5 and 10 liters (1 1-3 and 2 2-3 gals.). The price paid in France for this gasoline is 50 centimes per liter, or 38 cents per gallon.

The cost of gasoline is therefore not a negligible item in the operation of an automobile, as it was considered in the United States some years ago, when it sold for 7 cents a gallon. The high price of gasoline has naturally encouraged the search for other fuels that might be used in internal combustion engines. At the time when the automobile began to establish itself firmly, in 1894 and '95, the gas acetylene drew considerable attention as having a great future before it, especially in the field of illumination. This gas has been known to scientists a long time, but it was only then that processes of manufacture had been invented by means of which it could be produced on a commercial scale. While the production of calcium carbide, the base of acetylene, is covered by patents and is confined to a few large works, a large number of inventors went to work to produce acetylene generators and burners.

At first the gas was often stored under pressure, and even in the liquid state under high compression. The latter method of storing acetylene has been found quite dangerous, on account of the great explosiveness of the liquid. At present acetylene is therefore always produced from its base substances, calcium carbide and water, at the rate at which it is used.

Acetylene gas has a calorific power of 12,200 calories per kilogram, which corresponds to 22.780 B.T.U. per pound. The calorific power of gasoline gas is 11,360 calories per kilogram. Acetylene is therefore somewhat richer than gasoline gas. The theoretical yield of gas of 1 kilogram of calcium carbide is 340 liters, but in practice, owing to impurities and losses, 300 liters is about the average obtained. In the formation of acetylene 1,000 parts of calcium carbide unite with 562 parts of water, giving 406 parts of acetylene and leaving a residue of 1,156 parts of lime.

In practical experiments it has been found that 1 h.p. hour can be produced with 150 liters of acetylene gas, which corresponds to a calcium carbide consumption of ½ kilogram. This figure has been obtained with stationary engines, working under steady load. The heat energy contained in this volume of acetylene is equal to the heat energy of 1-12 gal. of gasoline.

In a gasoline engine of small size, such as are used for automobile work, an indicated horse-power hour can be produced at an expenditure of gasoline of 1-10 to ⅛ gal., weighing from 267 to 334 grams. As stated above, the carbide for 1 h.p. hour weighs ½ kilogram, or 500 grams, and 273 grams of water are required, making a total of 773 grams. Comparing the two fuels, in respect to the weight which will furnish a certain amount of energy in the engine, we find that the gasoline has a great advantage.

The cost of the carbide would also be somewhat higher. While ⅛ gal. of gasoline would come to about 5 cents here, the retail price of carbide is 15 cents per kilogram, which gives 7½ cents for ½ kilogram, the consumption per horse-power hour.

But it must be remembered that the above figure—150 liters of acetylene gas per indicated horse-power hour—has been obtained with stationary engines and under ideal conditions—that is to say, running constantly under full load. The varying conditions of power required on automobiles not only reduce the efficiency of the engine, but render the regulation of the acetylene production a very difficult subject. It is well known that the regulation of the acetylene production in bicycle lamps, where the consumption is constant, is very difficult. Here the regulation depends upon the adjustment of the water supply. A change of road surface will, however, make a difference in the amount of water admitted. If the lamp has been adjusted for smooth pavement the acetylene will be constantly blowing off on rough roads.

In a generator for motor vehicle use the acetylene production would have to be governed by the gas pressure. The acetylene production lags, ordinarily, considerably behind the regulative manipulations. For instance, the water may be turned off from the carbide retainer of a bicycle lamp, and yet the lamp will keep on burning for a half hour or more.

A better method of acetylene generation is certainly to feed the carbide into the water tank through a hopper governed by the pressure in the acetylene tank. While with the former method the carbide rises to a high temperature during the process of acetylene production, there is no appreciable rise of temperature in any part of the apparatus when the latter method is employed.

The regulation of the acetylene production to such a degree as to prevent any serious waste is certainly a difficult subject. A gas reservoir between generator and engine might be suggested to receive the surplus acetylene generated when the engine is running light, and give it out again when the engine works at full load. There are, however, objections to this plan. In the first place, a reservoir large enough to hold any amount of the gas at low pressure would be of such cumbrous dimensions that its disposition on a vehicle would be a thing of impossibility, and secondly, the constant variation of the pressure in the reservoir would prevent the obtaining of a uniform mixture in the cylinders.

On account of the waste of acetylene which would necessarily accompany its use on motor vehicles, with present-day generating apparatus, it is to be expected that the consumption of calcium carbide per horse-power hour would be considerably greater than that indicated above. The weight of carbide and water necessary to cover a certain distance and the cost of the carbide would increase in the same proportion.

There are being installed at the Exposition, in the building devoted to acetylene, some engines which are to be operated by this gas. The Exposition will therefore undoubtedly furnish some new data as to the cost and other considerations regarding acetylene as a motor fuel.

The use of alcohol in internal combustion motors has been championed by a number of French automobilists and has been the object of a contest organized by Le Vélo, a Parisian

cycling and automobile daily. The sum of 1,000 francs has lately been donated by the Prince d'Arenberg to organize another alcohol contest.

Gasoline is a foreign product, as far as France is concerned, being chiefly imported from the United States, while all the alcohol that could be used for vehicle motors could be produced here. It is thought that if the Government would take the tax from denaturated alcohol, to encourage its use, it could be sold retail at 25 centimes per liter, just one-half the present price of gasoline. The use of alcohol might also reconcile the country population to the automobile, a result which would be much appreciated by touring chauffeurs.

The French law requires that the denaturation of alcohol shall be effected by the addition of a fixed ratio of methylene, heavy benzine and green malachite, in such proportions as to make them constitute 14 per cent. of the mixture. The addition of these denaturating agents is the cause of a number of inconveniences. In the first place, the gallon of denaturated alcohol has less available energy than the gallon of pure alcohol, and, secondly, the combustion of these denaturating agents leaves a residue which will settle on the operating parts of the engine, such as igniter electrodes and valves, thus preventing their proper operation.

The calorific power of pure alcohol and of gasoline of a certain degree are well known, and it might be thought possible to calculate from these the relative merits of the two fuels. While this is true, to a certain extent, in practice much depends upon the particular motor and carbureters used.

The heat energy of a kilogram of alcohol is, according to Aimé Witz, the French gas engine authority, 7,183 calories, while that of gasoline, as stated above, is 11,360 calories per kilogram. The gasoline contains, therefore, more energy than the alcohol in the ratio of 1.6 to 1. The ratio furnished by some practical tests is found to be even more unfavorable to alcohol.

M. Hospitalier, a well-known French engineer and writer, has calculated that to produce an equal power at an equal angular velocity an alcohol engine must have four times the cylinder displacement and three times the weight of a gasoline engine. This calculation is, however, not credited by the alcohol enthusiasts, nor can it be said that it is supported by the tests that have been made.

The firm of Panhard & Levassor, who have been experimenting with alcohol, state that they found a reduction of the motor power of about one-third. They simply filled the gasoline tank with alcohol and made no changes on the motor.

The Vélo contest of alcohol-driven vehicles was held on April 11, 1899. It can hardly be called a contest, as only one vehicle ran over the course prescribed. This was not due to a lack of interest in the subject, nor due to the adverse qualities of the alcohol, but to the apparent fact that the elements had combined against the new motive power. It was raining in streams, and only two of the eleven competitors entered were willing to start.

M. Petreano, of Budapest, who had made some experiments with alcohol at Berlin, and thereby given the subject a new impulse, was present. One of the vehicles which were to start, that of M. Mouter, was provided with a special carbureter, designed by M. Petreano; but as it often happens, the instrument refused to work at the important moment and M. Mouter had to resign his intention of taking part in the contest. The only vehicle starting was that of Briest. It was a light vehicle, weighing 400 kilograms, or 880 lbs. It made the distance between Paris (Porte Maillot) and Chantilly (68 kilometers, or 42 miles) in 4 h. 8 m. The consumption of alcohol was 19 liters, or 5 gals., giving 8½ miles per gallon.

A vehicle weighing 880 lbs. and carrying two passengers ought to run about 15 miles per gallon of gasoline, and it was the opinion of those that were to judge the contest that with gasoline the consumption would have been 11 liters instead of 19. The use of alcohol is therefore not commercially justifiable unless its price is about one-half that of gasoline. With the actual prices of alcohol and gasoline, the cost of the fuel for this trip was found to be about three times as high as it would have been with gasoline.

The valves and igniters were inspected after the test and were found to be free from deposit. It must be remembered in this connection that the run was made with ordinary or pure alcohol, and not with the denaturated alcohol, of which it is supposed the price can be reduced by relieving it of the taxes.

Comparing the prices of gasoline, calcium carbide and alcohol in the United States it can be said without fear of contradiction that the chances of the latter two being applied to the propulsion of motor vehicles in place of gasoline are really very small.

## Some Properties of Acetylene.

By Herbert L. Towle.

Theoretically, 1 pt. or lb. of water should suffice for the decomposition of 2 lbs. of carbide; and each pound of carbide, if pure, should yield theoretically about 5.6 cu. ft. of acetylene at atmospheric pressure. Practically, on account of the impossibility of making use of all the water supplied to the generator, since much of it simply goes to wet down the sludge of lime resulting from the reaction and since much more of it is evaporated, not less than 1 lb. of water should be allowed to each pound of carbide. Again, carbide is never pure, and it is never possible to obtain all the theoretical yield of gas from it, partly because of failure of the carbide lumps to wholly decompose, partly from unavoidable "air slaking" of the carbide, partly from polymerization if the generator be badly designed, partly from leakage and very largely also from the readiness with which acetylene is absorbed by water. One volume of water will absorb 1.1 volume of acetylene gas under atmospheric pressure, and if the pressure be doubled the absorbing capacity of the water is doubled likewise.

It results therefore that a yield of 5 cu. ft. of gas per pound of carbide at atmospheric pressure is considered excellent, and a generator may fall ½ ft. or more short of this and still have enough other good qualities to recommend it.

The principal impurities of commercial acetylene are phosphoretted and sulphuretted hydrogen. Pure acetylene has a not unpleasant etherlike odor, and the strong smell of the commercial product is due to small admixtures of the above gases. The latter is not usually of much importance. The former gas ignites spontaneously in the presence of oxygen, and if evolved locally from the carbide in any quantity it might be a source of danger. Practically it is seldom present in quantities exceeding 1-10 of 1 per cent., and it ceases to be dangerous as soon as it mingles with and is diluted by the main body of acetylene gas.

Leaving out of account the class of wholly non-automatic generators, as being inapplicable to portable uses, as in motor

vehicles, a broad distinction may be made between generators in which the water is fed to the carbide and those in which the carbide is fed, in small lumps, into a large body of water. In the former class either the water drips on the carbide in quantities regulated by the gas pressure, or the carbide is contained in a metallic basket, which may be lowered into the water by being suspended from the bell of the gas holder, or about which the water may be allowed to rise by reduction of the gas pressure, as in the familiar hydrogen generators of the laboratories. All generators of this sort are open to the objection that a considerable quantity of heat—415 calories per gram of pure carbide—is set free by the reaction between the carbide and the water, and if the carbide is in excess this heat will be localized, resulting in very high temperatures at the point of reaction. It is even possible for a carbide basket, lifted out of the water by the rising of the gas holder bell, to become red hot before the moisture carried with it is absorbed.

Overheating of this sort, besides injuring the quality of the carbide, results in changing the character of the gas. Acetylene polymerizes at a temperature of 600 deg. C., several molecules of acetylene uniting to form one molecule of a new compound. Thus benzol, $C_6 H_6$, styrol, $C_8 H_8$, etc., are formed; and by interaction of these products other compounds result, such as anthracene, naphthalene, etc., having unequal numbers of C and H atoms; the residual atoms going to make up tarry products which cover and blacken the carbide and are condensed in the pipes and at the burners.

For these reasons most authorities agree that it is best to add carbide in small quantities to an excess of water, which will take up the heat liberated and keep the carbide cool. The yield of gas from these generators is somewhat smaller, owing to absorption of the acetylene by the water, but this is reduced in some generators by floating a film of oil on the water's surface.

Prof. Vivian B. Lewes, in a series of lectures before the Society of Arts, Nov. 21 to Dec. 19, 1898, gave the following as the requisites of a good generator:

1. Low temperature of generation.
2. Complete decomposition of the carbide.
3. Maximum evolution of the gas.
4. Low pressure in every part of the generating apparatus.
5. Ease in charging and removal of residues.
6. Provision for removal of all air from the apparatus before generation of the gas.

In any generator provision should be made for the increase in bulk of the lime residue over that occupied by the carbide. Ordinarily the lime will occupy double the space of the carbide.

In an article in The Builder, March 3, 1900, on the generation of acetylene, the requisites of a good generator are stated as follows:

"1. Excessive heating should not occur during the decomposition of the carbide. The lime sludge left after the decomposition should be white or light gray, not yellow or black, with tarry matter.

"2. The air space in the generating chamber should be as small as possible in order to avoid the production of an explosive mixture of acetylene and air when the apparatus is first employed. In any case it is advisable when first working a generator to blow off the first small quantity of gas obtained, at a point far removed from any flame.

"3. An arrangement should be provided by which, if the gas outlet from the generator becomes choked, the gas may escape into the open air without injury to the apparatus.

"4. No lumps of undecomposed carbide should be found buried in the sludge upon cleaning out the generator.

"5. Not less than 4¼ cu. ft. of gas should be obtained from a pound of good commercial carbide."

The same article in The Builder gives the following description of two representative generators of English make:

"In the first the water rises slowly around the carbide. A vertical generator is attached to the side of a gas holder, from the tank of which the supply water for the generator is taken. The connecting supply pipe between the generator and the gas holder tank is so fitted that when the gas holder bell (which has a displacement cone or float within it) is in its lowest position the water level is above the top of the pipe, and consequently water flows down the pipe and rises within the generator to the carbide, which is contained in perforated cages or trays. The gas produced escapes from the top of the generator to a small charcoal purifier or scrubber, and from thence through a water seal to the gas holder, the bell of which rises and causes the level of the water in the gas holder tank to fall below the level of the open end of the generator supply pipe. The generation of gas gradually ceases and no more water flows to the carbide until the withdrawal of gas from the bell causes it to sink and again raise the level of the water in the tank until it reaches the open end of the supply pipe.

"The gas on leaving the gas holder passes through a long condensing coil fitted within the gas holder tank, and any liquid which may be found is drawn off from a catch box at the bottom of the coil."

The second generator described belongs to the class in which small quantities of carbide are automatically discharged into a comparatively large volume of water. "The carbide container is situated above a revolving cone with horizontal axis, into which cone the carbide falls by its own gravity. This cone is actuated by a water wheel on the same axis, each movement of which causes a charge of carbide to be discharged into the water within a perforated basket fitted inside the generator tank beneath.

"When water is discharged into one of the pockets of the water wheel until the pocket is filled, the wheel turns a quarter revolution. The discharge of water into the pockets is regulated by the rise and fall of a gasometer bell, the walls of which displace the water in the gas holder tank and cause it to overflow upon the wheel when the bell has sunk to a certain position, owing to gas being withdrawn from it. The water which rotates the wheel falls subsequently into the generator tank, which is provided with a suitable overflow arrangement.

"In order to maintain a constant level of water within the gas holder tank when gas is not being withdrawn from it, a water regulating tank, fitted with double ball valves and an overflow, and connected with the water main, is provided. A box shaped cover slips over the carbide container and water wheel, and dips some distance into the water, thus forming a gas-tight seal."

Acetylene is what chemists call an "endothermic" compound—that is, it may be formed from its components, carbon and hydrogen, by the application of heat, as, for example, by an electric arc between carbon pencils in an atmosphere of hydrogen. Under proper conditions it will decompose again into its elements, and when it does this it sets free the same quantity of heat that would have been necessary to combine those elements if it had been formed by synthesis of carbon and hydrogen instead of, as usual, by a reaction between water and a carbide.

Acetylene has not been decomposed under atmospheric pressure, even under high temperatures. It decomposes spontaneously at 780 deg. C., but not, apparently, unless its pressure is at least two atmospheres. Decomposition may be started by electric sparks, glowing wires, or fulminate caps. Apparently it is not decomposed by shocks even when liquid. Its critical temperature, or the temperature above which it will not liquefy under any pressure, is 37 deg. C. At this temperature it liquefies under 68 atmospheres pressure. The activity of its decomposition is proportional to its pressure, and if liquid acetylene in a steel flask is fired by a hot wire it detonates with fearful violence and gives rise to pressures which no structure made could resist, being estimated at from 71,000 to 100,000 lbs. per square inch. The instantaneousness of the explosion is indicated by the fact that the flask is not simply ruptured, but shattered into small fragments. On this account the use of liquid acetylene is prohibited in England, and also in New York City at least in this country.

Under low pressures the decomposition started by a spark or hot wire remains local, not spreading far from the starting point, and its progress is of only moderate rapidity. An interesting series of experiments on acetylene, under moderate pressures up to three atmospheres, is reported by Prof. W. G. Mixter, of Yale University, in the American Journal of Science, January, 1900, under the title, "On the Products of the Explosion of Acetylene." In the first experiments the gas was inclosed at atmospheric pressure in glass tubes 15 millimeters internal diameter by about 20 centimeters long, but with their ends drawn down small and rather long. The tubes were then sealed and heated to temperatures from 325 to 478 deg. C., and then strong sparks were passed through them. A flash or puff was observed and the decomposition spread to a greater or less extent, depending in a general way on the temperature to which the tube had been heated. At 325 deg. only 7 or 8 per cent. of the gas was decomposed, but this increased rapidly with further additions of heat, and at 340 deg. and above from 50 to 70 per cent. was decomposed. From 20 to 40 per cent. of the gas remained undecomposed, that in the small ends of the tube never being affected, and the balance took the form of condensation products.

A second series of tests was made with sealed U tubes from 10 to 17 millimeters internal diameter and containing from 15 to 80 cubic centimeters of gas in one end, the lower part of the tube being filled with mercury so as to indicate the pressure. In these tests the gas was under three atmospheres pressure. In four cases out of ten the explosion was prompt and energetic, and in two it was slow. From 40 to 79 per cent. of the gas was decomposed and from 5 to 55 per cent. remained unaffected. In two experiments the spark was passed close to the end of the tube, and the carbon deposited on the walls of the tube showed the form of successive rings, suggesting a peculiar wave motion about the decomposition.

The third series of experiments was the most interesting, as showing the difference between the action of acetylene in small tubes and in larger volumes. An iron bomb or cylinder was prepared, of 1 liter capacity, and with no narrow necks in which the gas might linger undecomposed, and this was filled with acetylene at a pressure of three atmospheres. The explosion was started by sparks passed through the center of the bomb. It was noiseless in all cases, but the result was apparent from the increased temperature of the bomb. In two cases the bomb was sealed and the explosion took place at constant volume. Only about 4.1 per cent. of acetylene was found after the explosion. The carbon was quite bulky, filling about half of the bomb and adhering rather firmly to the metal. Five other experiments were made, using a safety-valve, not very large, which was intended to allow the explosion to take place at constant pressure. In these instances gas and carbon escaped for perhaps three to five seconds and burned with luminous but smokeless flame. The percentage of residual acetylene in the bomb was nearly the same as before, being from 4 to 7 per cent. In all the experiments the heat developed by the decomposition was very great, cracking a glass insulating stem inside the bomb as if it had been dipped when hot into cold water, and repeatedly melting and rendering brittle the platinum wires between which the sparks were passed.

In discussing his results, Prof. Mixter expressed the belief that the residual acetylene found was the result of synthesis after the explosion, due probably to the glowing carbon thrown down by the decomposition. It seems hardly probable that at the moment of the explosion any of the gas failed to be heated to the necessary temperature for decomposition.

## The Properties of Acetone.

Acetone is an organic compound. One can consider it as an oxidation product of the isopropyl alcohols. It is a colorless liquid with a decided odor and taste, and when pure dissolves in all proportions in water, alcohol, ether, sulphate or chloroform. The dissolved water can be removed by chloride of lime. A liter of acetone weighs at 0 deg. C. about 814 grams, boils at 56 to 80 deg. C., and burns with a luminous, smokeless flame.

The aqueous solution of acetone, equal parts of each by volume, can be readily lighted by a match, which, however, is impossible when there are present five volumes of water to one of acetone. The impurities which are most frequently associated with it are of the strong smelling organic compounds —acetic acid, aldehyde, ethylene and water.

When shaken up with water it must neither become cloudy nor milky. A cloudiness indicates the presence of animal or vegetable substances. A reddish solution indicates acidity, usually due to acetic acid. On the addition of an ammoniacal solution of silver nitrate and then warming slightly, no dark deposit of metallic silver should appear. Such reactions indicate the presence of aldehyde or other organic substances.

Acetone should contain no water, comparatively, when it is to be mixed with carbonate of potash, as then the potash salt remains dry. When acetone is allowed to evaporate on a watch glass it leaves no residue. In order to remove the water, Castellani employs calcium carbide, which unites with the water, forming acetylene gas. A piece of calcium carbide in dry acetone produces no gas; but when 2 or 3 per cent. of water is present, small bubbles of acetylene appear, which seldom get as far as the surface of the acetone before they are absorbed. If carbide is thrown into a solution of equal parts of acetone and water the solution begins to foam rapidly.—The Progressive Age, translated from the Zeitschrift für Beleuchtungswesen.

## Acetylene and Gasoline.

By L. Berger.

If we wish to compare the results to be expected from an acetylene mixture with those from a gasoline mixture, when exploded in the cylinder of an automobile motor, it is necessary first to make a theoretical comparison between these two systems of power on the following points:

1. The specific heating power of the mixture.

2. The quantity of air required for total combustion of the mixture.

3. The resulting pressure of the mixture on explosion.

Acetylene, $C_2H_2$, has an atomic weight of 26, and a specific volume at 0 deg. C. and 760 mm. of mercury of 860 liters, or 0.860 cubic meter per kilogram. The experiments of M. Berthelot indicate that the energy liberated by its chemical decomposition into its elements is 2,235 calories per kilogram. The complete combustion of these elements requires 3.08 kilograms of oxygen per kilogram of acetylene, corresponding to a volume of 2,156 liters, or 2.156 cubic meters of oxygen for 1 kilogram of acetylene; or in other words, 9.281 cubic meters of air.

The combustion of this mixture yields 9,490 calories of energy, so that for the total reaction we have a yield of 2,235 calories due to decomposition of the acetylene and 9,490 calories due to oxidation, or a total of 11,725 calories per kilogram of acetylene completely oxidized. The experiments of MM. Berthelot and Vieille give 17.2 as the factor representing the increase of pressure on explosion in a closed vessel—i. e., if the initial pressure be represented by 1, the pressure after explosion will be represented by 17.2. The corresponding rise in temperature is 5,226 deg. C., and the volume of the gases on cooling to their initial temperature and pressure is $\frac{3}{3.5} = 0.85$ of their original volume before the explosion.

For an average gasoline of 0.70 density and composed chiefly of hexane, $C_6H_{14}$, having for its vapor a specific volume, at 0 deg. C. and 760 mm. of mercury, of 0.260 cubic meter per kilogram, corresponding to a vapor density of 2.975 (air being 1), it is necessary to employ 2.478 cubic meters of oxygen for the complete combustion of 1 kilogram of gasoline vapor, or 10.667 cubic meters of air. This is in the proportion of 2.4 per cent. of gasoline vapor at 0 deg. C., or of 13.4 volumes of liquid gasoline to 100,000 of air, and corresponds to the point of sharp explosion in Prof. Boverton Redwood's experiments, table No. 11 (quoted in Mr. Stoddard's article in the Explosive Motor Number of The Horseless Age). The explosion of this mixture gives 11,086 calories of energy per kilogram of gasoline. The rise of temperature is 4,191 deg. C., and the factor of increase of pressure is 20.2, while the resulting volume (when cooled) is $\frac{13}{10.5}$ or 1.24 times the original.

From these theoretical experiments in a closed vessel we see that the gasoline gives a higher pressure on explosion than acetylene. The proportion of vapor to air, as seen above, will be as 1 to 41 at 0 deg., while in the case of acetylene it is as 1 to 11. Generally the proportions used in practice will not be far from the theoretical, as indicated by the experiments of Prof. Redwood on gasoline and by the French experiments on acetylene.

In France the experiments of Georges Richard on an ordinary Benz motor with acetylene have shown that the explosive effect is short and violent, and that the regulation of the mixture is difficult. If we add that the initial decomposition of the gas into its elements results in a deposit of carbon on the cylinder walls, and that this entails much loss of heating power, we must conclude, in spite of the troubles involved in gasoline carburetion and the disturbing effect on the vapor tension of a change of temperature at the carbureter, that better results are to be expected with gasoline in automobile motors than with acetylene.

## Acetylene Generators for Motor Vehicles.

By W. F. Cooper.

On account of the much greater heat energy of acetylene in comparison with an equal volume of any other gas, its application as a motive power in explosion motors would manifestly present many advantages if capable of general application. The gas, if generated from calcium carbide in a proper manner, being of a permanent or fixed nature, can be admitted to the cylinder of the motor in much the same manner that it is utilized in the ordinary gas engine, doing away with the necessity of a vaporizer and more or less complicated mixing valves. It also reduces to a certainty the proportion of the mixture, thereby securing a regular and uniform explosion.

There is also an apparent advantage in the use of acetylene, in that the gas can be ignited at a much lower temperature than other gases, the ignition taking place at a dull red heat.

The most serious obstacle at present to the practical application of acetylene for the propulsion of motor vehicles would appear to be the construction of a suitable apparatus that would meet the unusual demands required in the supplying of an ever varying quantity of gas.

It would be manifestly impossible to utilize any type of generator that requires the storing of any considerable quantity of gas, unless the gas should be concentrated and liquefied in steel cylinders at a pressure of several hundred pounds to the square inch; and that method has been rendered prohibitive on account of the several disastrous explosions resulting therefrom.

Acetylene, although non-explosive at the ordinary temperature and pressure, unless mixed with air, becomes at a pressure sufficient to secure liquefaction a true explosive, that is liable to detonate at certain temperatures, with decidedly serious results.

Obviously, therefore, the most practical method of utilizing acetylene would be some type of a generator in which the gas is produced from the carbide only as fast as consumed.

There are two distinct classes of generators at present used in the production of acetylene—that in which the water is fed to the carbide and that in which the carbide is fed to the water.

Both these classes are also capable of being divided into two general divisions—one in which the feeding of the water or carbide is practically continuous, and the other in which a large surplus of gas is generated intermittently, the extra gas being stored in some type of a gas holder until used, when another charge of gas is automatically produced.

The generators in which the gas is produced intermittently being obviously too large for motor vehicle work, it would appear that the only types available would be those in which the gas is generated in a practically continuous manner.

Of these latter types, that in which the water is fed to the carbide is open to several serious objections, the most important being that the high temperature in the mass of carbide, caused by the chemical union of the water and carbide, results in the polymerization of the gas.

Very often in this type of generator the carbide will be heated to such an intensity that it will be raised to incandescence. Long before such a temperature is reached the gas will begin to disintegrate, forming tars, naphthalene and many other related hydrocarbons.

Such a gas condenses in the pipes and even in the cylinders of the motor, resulting in their stoppage by a viscous brown mass.

The water feed or "drip" apparatus also has the serious objection of an excessive after-generation, caused by the slaked carbide being saturated with water, which attacks the unslaked carbide after the water supply has been shut off.

Although almost numberless attempts have been made to overcome the objections of the drip apparatus, as evinced by the United States Patent Office reports, the production of a successful generator on the water feed principle, that does not occupy too large a space, has yet to be realized.

Apparently the only serious objection to the carbide feed type of generator is that it would appear to be difficult to so construct it that it will feed the carbide to the water in a perfectly automatic manner without being too large and intricate in its mechanism.

The carbide being dropped in an excess of water, the heat is thereby absorbed and any polymerization of the gas prevented. The carbide, if utilized in a granular form, and fed to the water in a practically continuous manner, would be instantly slaked by the same, avoiding the production of all after-generation, while at the same time supplying any quantity of gas desired.

This type of generator, although offering an inviting field for improvement, has received but little attention in this country.

Whatever method of producing acetylene is adopted, it is evident that the construction of an apparatus that will meet the various requirements of motor vehicle work is a matter of no little difficulty.

The writer has obtained, with apparatus not expressly designed for motor vehicle work, results which have demonstrated the practicability of realizing with acetylene fully double the brake horse-power produced with the ordinary gasoline motor. The first results were somewhat disappointing on account of the production of a large amount of soot in the cylinder, but later experiments demonstrated that the trouble was caused by the admittance of too large a proportion of gas to air.

The exhaust, although louder and sharper than in the gasoline motor, is remarkably free from the odor of unburnt gas.

With the production of a suitable apparatus for the generation of the gas, there can be no doubt that it will have an extensive application for the propulsion of motor vehicles.

## The Accumulators of Acetylene.

One hardly knows where to find a more suitable term to describe the apparatus designed for the storage and transport of acetylene. In view of the dangerous nature of liquefied acetylene, the transport of acetylene energy cannot be accomplished under that form.

Two methods are actually employed—dissolving the gas in acetone and compressing it into a porous body.

On account of the suppression of the resolvent and the relatively low cost of porous substances, storage by compression is more economical than storage by solution, and in certain cases where no great quantity of the gas is required the former method may be applied to advantage. Thus it is more suitable than the second method for the lighting of railway and street cars, where the containers must be placed at the top of the car. In that case, indeed, the containers reach in summer a fairly high temperature, and as the solubility of acetylene in acetone decreases quite rapidly when the temperature is raised, the pressure may readily become greater in such containers than in those of compressed acetylene alone; the safety valves begin to act, and a notable portion of the stored gas is thus lost.

After developing the above particulars regarding the two methods which may be employed for the transport of acetylene in reduced volume, M. Janet, in his last lecture before the Société d'Encouragement, made known some applications of them, either already realized or about to become so.

He pointed out in the first place the application to the lighting of the voitures du funiculaire of Belleville, where acetylene in solution is used, and also that of the voitures Porte d'Ivry-les-Halles, where compressed acetylene is employed. He then showed a sort of acetylene torch, composed of a long cylindrical reservoir having a circle of burner tips at its upper end. The apparatus is of light weight and may readily be carried on the shoulder like a musket. It is adapted for service in any place where there is need of an intense illumination, as, for example, in wrecking operations after a railway accident. By interposing a disk of red glass in the path of the rays the torch may be used as a signal for the protection of a train when stopped on an open track, and will necessarily be much more efficient than the oil lantern ordinarily used for the purpose. Pursuing the same thought, the lecturer showed a rear-end signal lamp fed by acetylene.

M. Janet then showed in operation various illuminating apparatus where the heat liberated by the combustion of acetylene is used to render Welsbach mantles incandescent. The realization of this method of lighting presents some difficulties. The acetylene gas, after issuing from the burner, must be mingled with a sufficient quantity of air to consume it completely. But the rapidity of inflammation of such a mixture is very great—much greater than the velocity of outflow generally allowable—and consequently the flame strikes back into the burner and no light is produced. Nevertheless, that difficulty has at length been surmounted, as was proved by the good performance of the burners exhibited by the lecturer. This mode of utilizing acetylene yields very good results on other grounds, since to the heat produced by the combustion of the carbon and hydrogen is added that resulting from the decomposition of the gas itself, so that a much higher temperature is obtained than by the combustion of illuminating gas.

With the "baby burner," so called, the advantage is not very marked, but with burners of larger size a considerable increase in lighting power is obtained by the substitution of acetylene for illuminating gas. In that form, acetylene illumination may be applied to the lighting of docks and yards, and recently an arrangement with Welsbach mantles has been used with success in the night work on the belt railway near the terminus of Courcelles. The net cost of that mode of lighting compares favorably with that of other methods, as

a candle-hour is obtained with a consumption of 2 liters of acetylene (122 cu. in.); and as a cubic meter (35.3 cu. ft.) of acetylene gas can be sold for 4 francs (80 cents), including setting up the apparatus, the price of a candle-hour thus comes to 0.08 centime.

As to the filling of the storage apparatus, this may be done either at the works or at the consumer's.

At the works there are great tanks of acetylene in solution, forming accumulators which it suffices to connect with the portable tanks to be charged. To accomplish the charging at the point of consumption, four tanks of a volume of 250 liters are filled which together hold 100 cubic meters of gas. These tanks are put on a wagon which carries them to the consumer; and they are there connected with the lighting or power apparatus.—Echo des Mines.

## Acetylene Motors.

How stands the question of the employment of acetylene for motive power? Several of our readers having asked us for information on the subject, we had recourse to M. Henri Cuinat, the skillful constructor of Séchilienne, who has made acetylene power a special study. The following is his answer:

"In response to your letter of 15th inst. I take pleasure in communicating the latest information within my knowledge on the employment of acetylene gas in motors.

"Since my experiments in May, 1896, on the application of acetylene to the production of motive power, various constructors have made new trials, notably the gas motor establishment of Deutz, who has lately improved his acetylene motor, so that it is now identical in mechanism and working with the Otto gas machine, with this difference, that the ignition is electro-magnetic, while in the gas motor it is produced by a tube heated with a Bunsen burner. The supply is by a valve. The cycle is quadruplex.

"The Gasmotorenfabrik claims that it is necessary that the acetylene should reach the motor absolutely dry. This is, in truth, essential to the proper working of the engine. I have myself noticed that in employing a moist gas the products of combustion are rapidly deposited on the electric igniter, and as these products are good conductors of electricity it follows that the insulating part of the igniter loses its property and the ignition is suppressed.

"The experiments of Deutz were made at a pressure of from 10 to 20 millimeters, and for this purpose a pressure gauge was placed between the gas generator and the motor.

"This pressure, which seems to be weak for acetylene lighting, is sufficient for acetylene power. The gas is regulated more readily at this pressure and mingles better with the air drawn in by the motor.

"The experiments with full charge resulted in a consumption of 200 to 250 liters per effective horse-power.

"This consumption is greater than I obtained with a motor of 6 h.p.—175 liters. It is explained by the fact that the Otto motor is an ordinary quadruplex engine, while my motor was one of prolonged expansion.

"Finally, the Otto acetylene motor attained a higher horsepower than the same motor worked by the city gas.

"Up to this time the application of acetylene to the production of motive power has not received practical sanction. So far as I know, no industrial establishment is thus operated.

"The reason is obvious. At the time of my experiments, notwithstanding the small consumption of acetylene, the cost of calcium carbide was 0.28 franc per horse-power, while with good motors worked by the gas of the Parisian company it was 0.16 franc.

"Since 1896 the price has fallen, but not sufficiently to allow the practical application of acetylene to motive power."

It seems, therefore, that the development of all the applications of acetylene—to lighting, to heating and to motors—is arrested by the cost of the carbide. When the electrochemists furnish us with carbide at 250 to 300 francs the days of coal gas will be numbered.—Journal de l'Electrolyse.

## Gas Engine Dimensions.

So far as the refusal of gas engine builders to publish the dimensions of their cylinders is inspired by a desire to make a "trade secret" of them, it is certainly open to criticism. But if a firm publishes the cylinder dimensions of its engines and these compare unfavorably, power for power and speed for speed, with those of competitors, it is certainly advisable to publish an explanation of that fact at the same time, else appearances will be decidedly against it. The following table, relating to a Canadian-built stationary engine and published by our contemporary, The Canadian Engineer, will be apt to strike readers in this country as a rather extraordinary confession of inability to keep up with modern ideas of speed and power. Possibly the ratings for power are much below the maximum, or possibly the engine is built to take a throttled charge and expand it beyond the usual point; but if so the fact is not explained:

| Actual H.P. | Speed Rev. per min. | Size of Cylinder. Dia. | Stroke. |
|---|---|---|---|
| 1½ to 2 | 250 to 350 | 5 in. | 6 in. |
| 2¼ to 3 | 240 to 325 | 5½ in. | 7 in. |
| 3 to 4 | 230 to 315 | 6¼ in. | 8 in. |
| 4½ to 6 | 225 to 300 | 7 in. | 9 in. |
| 6½ to 8 | 215 to 265 | 7¾ in. | 10 in. |
| 8½ to 10 | 205 to 240 | 8¾ in. | 11 in. |
| 10½ to 12 | 200 to 230 | 9¼ in. | 12 in. |
| 13 to 15 | 195 to 225 | 10 in. | 13 in. |
| 16 to 20 | 170 to 210 | 10¾ in. | 15 in. |

## Gas Engine Formulas and Diagrams.

E. J. Stoddard, who is well known to readers of The Horseless Age, has sent us a copy of his pamphlet on "Gas Engine Design," which is published by Parker & Burton, 12 Hodges Block, Detroit, Mich. The purpose of the pamphlet is to present in compact form the leading mathematical data relating to the gas engine indicator diagram and to the subjects of vibration, speed, valves, mixture proportions, etc. The indicator diagram is considered with reference to preliminary power calculations; and original formulas, derived by Mr. Stoddard from the equations of the adiabatic curve, are given, which greatly simplify this preliminary work. Formulas for proportioning the working parts are also given, and the entropy diagram is considered and explained.

Some of the material of the pamphlet has been published from time to time in The Horseless Age, but much has been added to it. Its publishers, Parker & Burton, state that it is intended as a vehicle for the announcement of the completion of their "Digest of United States Patents." It is sent free to any address on request, and will be found a useful and up-to-date addition to the gas engine designer's library.

## France Secures the Cup.

The first race for the Gordon Bennett International Cup was run on June 14 according to arrangement. It was won by Ferdinand Charron, of the Automobile Club de France, with M. Girardot second. M. Charron covered the distance—351 miles—in 9 h. 9 m., or at an average speed of 38.4 miles per hour. The rules of the race required that the speed of contestants should be reduced to 12 kilom. per hour when passing through towns and villages, any time gained by a higher speed being deducted from the total at the end of the run.

The three Belgian competitors had given notice of withdrawal, ostensibly owing to the short time allowed for preparation and because their request for a postponement had been refused. It was reported, however, that they wished to make alterations in their machines. Nevertheless, at the last moment one of them, M. Jenatzy, entered the race with another machine, while Herr Engen, the German competitor, withdrew, as the tires of his machine were not ready. The contestants actually starting were as follows:

René de Knyff, France.
M. Jenatzy, Belgium.
Alexander Winton, United States.
M. Charron, France.
M. Girardot, France.

Comte de Chasseloup-Laubat acted as starter.

The start was made at 3:14 in the morning from the entrance to the Parc de Saint Cloud, on the Versailles road. M. Girardot led at first, and in the next few miles the second place was held successively by René de Knyff, Jenatzy and Charron, with Winton last, but following closely.

At Limours, a distance of 30 kilometers (18.6 miles), the times were:

Girardot, 3 h. 49 m. 15 s.
Charron, 3 h. 52 m.
René de Knyff, 3 h. 53 m. 30 s.
Winton, 3 h. 59 m.
Jenatzy, 4 h. 29 m.

At Chateaudun, 125 kilometers (77.6 miles), the times were:

Charron, 5 h. 40 m. 55 s.
Girardot, 5 h. 14 m. 44 s.
Jenatzy, 5 h. 51 m. 56 s.
Winton, 6 h. 28 m. 50 s.

Mr. Winton went by with a bent front wheel and a rear tire badly split. M. de Knyff's time was not reported at the above point, but at Les Ormes the times were:

Girardot, 5 h. 49 m.
Charron, 5 h. 55 m.
René de Knyff, 6 h. 41 m.
Jenatzy, 6 h. 46 m.

Mr. Winton abandoned the race at this point, coming into Orleans at 8:30, two hours and a half after Girardot and Charron, and announcing his intention to get a new tire there and return to Paris. René de Knyff arrived at Orleans shortly before 7 o'clock, at a walking pace. His fourth speed had broken shortly after leaving Chartres and he continued the race only to Glen (146.5 miles), which he reached at 11:35, and there abandoned the race.

M. Charron bent his rear axle near Orleans in crossing a gutter, but he still held his course. Girardot broke a rear wheel against the curbstone shortly after while trying to avoid a frightened horse. The damage was hastily repaired at a neighboring blacksmith's, but it cost over an hour's delay, and Charron, who till then had been over a quarter of an hour behind, thus gained first place.

Nevers (200 miles) was reached by Charron at 8:42, and he stopped there for supplies.

At La Palisse (265 miles) Charron passed at 10:09, and Girardot at 11:04. At Roanne (286.5 miles) Charron passed at 11:03 and Girardot at 11:41. Jenatzy had burst his two front tires at Chevreuse and was out of the running.

The finish of the race was at the Restaurant des Delices de la Demi Lune, a hostelry some six miles out of Lyons. Thither proceeded a perfect swarm of chauffeurs to welcome the victor, among them being M. Brun, vice-president, and MM. Burdet, Santoux and Bernard d'Anjerville, of the Automobile Bicycle Club; M. Stead, Paul Meyan, of La France Automobile; M. Rigoullat, Capt. Barrison, chief of the automobile section of the Fourteenth Army Corps; M. Colin, president of the Motor Club; Clarence Gray Dinsmore, the American delegate, and many others.

M. Charron arrived shortly after noon very much exhausted. Another accident, this time to his pump, had occurred 7 miles before the finish. At 2 o'clock M. Girardot arrived, and the official times at Lyons are as follows:

1. Charron, 9 h. 9 m. 49 s.
2. Girardot, 10 h. 30 m. 28 s.

In the evening the Automobile Bicycle Club of Lyons entertained the two successful chauffeurs.

## Agitating for the Freedom of the Parks in Boston.

Another agitation in favor of making the Boston parks free to automobiles at all hours has been started. The matter was dropped temporarily late last year, after being agitated more or less all through the summer and fall, and now it appears that a numerously signed petition from influential users of motor carriages has again called for a change in the Park Commission's interdiction. The petition is headed by Hon. T. Jefferson Coolidge, Jr., and includes the names of Allen Curtis, 2d, C. S. Tuckerman, H. L. Higginson, Gardner M. Lane and about 125 others. Its wording is substantially as follows:

"The undersigned users of motor vehicles of different types respectfully petition your department that its regulation covering the operation for motor vehicles in the public parks and boulevards be amended by striking out the second paragraph of the same, so that any person who has received a permit from the inspector of your department shall hereafter have the right to run and operate a motor vehicle of any type which has received the approval of said inspector, at all hours."

The three last words are the important ones, for at present the regulations prohibit automobiles in the parks after 10:30 o'clock in the morning and before 9:30 o'clock at night. It is understood that a counter petition is being circulated by opponents of the auto, which also will have numerous signatures. It is said in some quarters that the real significance of the opposition is the desire of the livery stable men to keep their present monopoly of the public carriage service in the parks free from encroachment by any motor vehicle company. The autos, once in the parks with public carriage privileges, would probably be able to cover more ground than the horse-drawn carriages at a lower rate of fare, and this explains the stable-keepers' opposition.

The Park Commission has named Monday, June 25, as the time for a hearing on the matter, and the meeting will take place at 64 Pemberton Square at 3:30 p. m. on that day.

# LESSONS of the ROAD

## Chapter Two.—The Vindication.

Hagerstown, Md., June 12.

Editor Horseless Age:

In your number of May 9 your contributor signing himself "Steam Carriage," after enumerating his experiences with his machine, says in conclusion that he sold it to some one who lived in Maryland, and it struck me that possibly you would like to hear the second chapter, as we might call it, of the workings of this steam carriage.

The purchaser of it was, as was the original owner, more or less interested in mechanical matters, and had a good-sized machine shop, and skillful men at his call. Likewise, he had no printed beginners' guide, and not even tuition for a couple of hours by an expert sent from the factory. By experience in running the machine, and by watching the many mistakes and accidents that your correspondent of May 9 notes, he learned to correct and avoid many—in fact, all of the objections that were noted by your correspondent.

He, too, learned that the fire would sometimes blow out, and that it did upon one occasion make a dangerous-looking flame, at which the small boys on the curb cried out, "Mister, you're afire." Since the burners have been overhauled and put in proper condition, he has never had the cry of fire raised, and on the few occasions when the fire has been extinguished by a sudden gust of wind (and this has only happened one or twice when the machine has been standing on a hill with a strong wind blowing), instead of lighting it with a match and having trouble with his matches blowing out, he simply uses an alcohol torch, by means of which he can ignite the gasoline at the burner.

The disagreeable features of the leakage of steam at the throttle and at other points have also been experienced, but a very slight acquaintance with the mechanism enabled the user to tighten up the joints and have no disagreeable happenings.

All the difficulties experienced by your correspondent in the mechanical construction of the machine we think he did not exaggerate, but all of them by a little care and knowledge and experiment were rectified, and the carriage was put in good and serviceable condition.

The machine has been used now for about six months over the ordinary country roads of western Maryland, some of them being good macadamized roads, and others being ordinary clay roads with heavy limestone outcroppings and very abrupt hills and little or no grading. The experiments with this machine were purposely made over some of the very worst roads in this part of the country, and the results noted in the consumption of gasoline and water over the different classes of roads were very interesting.

The amount of fuel carried by the machine—about 3 gals.—has been found by numerous experiments to be ample for 30 miles over the macadamized roads in this neighborhood, which are in moderately good condition, and have not excessive grades. On the ordinary dirt roads, with considerable limestone outcroppings, and with little or no attempt at grading, the fuel—3 gals. of gasoline—will answer for 25 miles. The water tank, which holds about 12 gals., would have to be renewed more frequently than the gasoline, one tankful of water being good for about 18 miles.

The expeditions which have been made in this steam carriage have gradually extended themselves over the whole of the neighboring country. We think nothing now of going out in the evening for a 25-mile ride, so far never having had an accident or a detention of any sort beyond stopping for a supply of water or gasoline.

Last Monday the machine was perhaps put to the severest test that it has had since being in the possession of the present owner, covering a trip in the afternoon of 40 miles, going up a mountain about four miles long, with fairly steep grades; going down the same mountain by another road, where the grades were excessive, having to replenish the gasoline once and the water twice, and making the expedition in four hours, exclusive of the time used in taking on the supply of gasoline and water. These necessary stops for fuel and water occupied not more than thirty minutes all told. Altogether, it was an exceedingly successful trial of the steam carriage for use on the ordinary country roads that are to be found anywhere throughout the land.

The location here is right between two ranges of the Blue Ridge Mountains, the country very rolling, of heavy red and yellow clay, and limestone cropping out on all ridges, the ordinary roads being anything but ideal for pleasure driving, the macadamized roads being fair, but not to be compared in smoothness and in moderate grades with the roads of New England, New York and New Jersey.

So far, in the six months' use of this steam carriage, it has been found perfectly possible and easy to so manage the exhaust that there has been no frightening of horses at all, the main uneasiness that the horses have evinced in the country having been over the approaching of a machine without a horse. But it has never amounted to anything that was not easily controlled, even in the most restless horses, and the driver of the steam carriage has been able so to manage the machine that he goes by horses without using the steam at that time—in other words, coasting by them, and with very satisfactory results.

Altogether, he is beginning to feel that a steam machine properly constructed, after the user of the same has become fully conversant with the points needing most attention, will be a very useful and practical machine for the ordinary roads that will be found throughout the greater portion of the United States, and perhaps the best machine for the very bad roads which are so prevalent in so many parts of our country.

E. W. M.

## Automobile Parade in Bridgeport.

The efforts of the Bridgeport, Conn., Post and Telegram to organize a motor vehicle parade for the morning of July Fourth have met with encouraging success. Many out-of-town motorists have signified their intention to enter, and a handsome solid silver loving cup has been offered by T. E. Griffin, one of the best known of Bridgeport's operators, for the best decorated automobile in line. This trophy is now on exhibition at E. W. Button & Co.'s jewelry store on Main St. The parade will start at 10 a. m., and some motor paced races are expected in the afternoon.

# OUR FOREIGN EXCHANGES.

## Sir David Salomons on Steering and Other Points.

Sir David Salomons, in the course of a recent lecture on "Modern Locomotion," had the following to say regarding constructional matters:

In the Peugeot engine points of convenience have been carefully attended to, and by the removal of one screwed cover the inlet and outlet valves of a cylinder can be removed. To give an idea how convenient this is, I will relate an experience. In consequence of my Panhard having been laid by for several weeks, the inlet valves stuck, and it was necessary to remove ten bolts to expose them. The mechanician was an experienced man, and he did this with considerable rapidity. All was replaced and the engine tried, yet the difficulty still existed. We had therefore to take it apart the second time, and the total operation lasted about twenty minutes. On the other side, a short time since, on leaving the gates of Broomhill to catch a train at Tonbridge, the engine of my little Peugeot car failed to respond. I believe the cause was due to cement dust from some building operations next door to where the carriage was placed, and which had got under the valves. The covers were removed and the valves cleaned and replaced without extinguishing the burners in the space of four minutes, and by running very sharp I caught the train. I do not give this instance with a view to puff one carriage and disparage another, but to show how necessary it is that makers should give attention to details which are of the greatest service to their clients.

Mr. Crompton in a recent paper stated that the limit of speed of a motor car should be merely the function of the brake. In Utopia such a law might hold good. My experience in France has been that whatever the functions of the brake may be, if the driver can send everybody flying off the road he will refrain from using it. I think myself that the speed in England being limited to 12 miles in open country is unreasonably limited, but for other places the law as it stands is good.

The steering mechanism is a vital portion of a carriage, as you must fully recognize. The methods at present adopted may be divided under four heads:

(1) The system of lever bars.

(2) The system of lever bars actuated by means of a rotary motion with an intermediate chain.

(3) By levers actuated by rackwork or cog wheels.

(4) By levers actuated by worm wheel and endless screw.

The latter is the one now adopted in the majority of Panhard & Levassor's carriages. No. 2 system is that adopted on the Peugeot cars. Speaking for myself, I prefer the Peugeot system. There is less vibration, and guiding is far easier. Against this system it is contended that impediments on the roads react on the handle bar and give shocks to the driver. Also that there is risk of the wheels being moved from their course by the obstruction unless the handle bar is held fairly tightly, but I can most positively assert that these objections are purely imaginary. In the early days, when less attention was given to details, there was some truth in the allegation, because the pivot on which the wheels turn did not plumb with the tread of the wheel on the ground. This is a most important point, and if the steering wheels are dished so that the points which touch the road are plumb with the pivots, there is no tendency whatever for the wheels to be shifted by impediments on the highway.

A gentleman mentioned to me that he was riding a Peugeot car when the driver hit the curbstone, causing the handle bar to be sharply turned. This of course would naturally happen, but then it must be remembered that had the steering been on the endless screw principle the chances are that the wheel would have been injured or smashed. I have driven carriages which have been steered by other methods, and in all cases I find that there was disagreeable vibration on the handles, which rendered steering tiring after a time. With the endless screw this vibration is not noticeable until after the carriage has been in use a short time. Then it makes itself apparent in consequence of the wear and tear.

I am ready to admit that for racing purposes the endless screw is the best system, as the course can be altered very slowly by this means, so that a less experienced driver can race more safely. Any one who has driven carriages with the various steering types mentioned discovers almost at once the extraordinary ease with which it is possible to wind in and out of traffic, however dense, with the system adopted in the Peugeot vehicles, viz., intermediate chain system.

There is a question whether it is better to place the motor in connection with the back or the front wheels. Theoretically it is better to have the front wheels driven, because it is better to start the carriage with these wheels placed at any angle. Except for this, there is not much to be said in favor of or against adopting this method. There is always a controversy as to whether one chain, two chains or no chain is the best way of transmitting the motion to the driving wheels. Many methods exist for driving without a chain, and it is curious to note that some manufacturers claim that patents are good in connection with methods, the whole of which have been known and published as far back as the year 1820, mainly in connection with steam road carriages, which first made their appearance about that time.

There is no objection to the use of driving chains if they are properly made. In some respects they have an advantage from the constructional point of view as well as convenience for making repairs. The only drawback to their use is that manufacturers appear to forget that the chain is nothing more or less than a flexible cog wheel, and although they take every care to protect other gear from dirt and dust, no measures are adopted to insure these benefits for the chain, which is quite as complex as the other mechanism.

## Closing the Inlet Valve.

In an article on "Poppet Valves: Their Construction and Calculation," in The Horseless Age of April 18, our contributor, L. Berger, laid especial stress on a point often overlooked in this country, namely, that owing to the momentum of the air in the inlet pipe a fuller charge will be received into the cylinder if the inlet valve closes a trifle after the piston has started on the compression stroke than would be the case if it were closed with the crank on the outer dead center.

This point is referred to in a paper by Jas. Dunlop, recently read before the British Association of Draughtsmen at Manchester. Describing the laying out of a cam diagram for

## Aluminum and Partinium.

Thanks to progress in manufacture, aluminum is now produced pure to within 93 to 99 per cent., observed by M. Henri Moissan to the French Academy of Science, while the most disadvantageous impurities—sodium, carbon, iron and silicon—are eliminated. An alloy containing 96 per cent. of aluminum would appear to be that most employed, and this metal, in the form of bars, angles, tees and plates, lends itself to all forms of construction that require extreme lightness combined with great resistance.

Among the many current applications of aluminum may be mentioned the following: In telegraphy and telephony, wires and cables; for military purposes, field and mountain gun carriages, armor plates, cartridge cases, sword scabbards, helmets, cuirasses and stirrups; in cycles, all detached parts; for lighting, coal gas and acetylene tubes; in music, wind instruments, and for surgery, all instruments, as well as kitchen utensils, watch cases and the metal parts of telescopes and field glasses. As regards new applications, this metal is largely used in the prosperous motor car industry, a large proportion of aluminum, and especially its alloys, being used, not only in the accessory parts of the frames, but also for the principal parts of the body; and, up to a certain point, it is possible to give the alloy the qualities of strength, cohesion, etc., required for each case.

Partinium, so named after its inventor, Henry Partin, is a mixture of aluminum (having the density of 2.56) with tungsten (having the density of 18), which alloy combines with the lightness of aluminum a resistance increasing with the tungsten content. Cast in sand, the density of this alloy is 2.86; its resistance to tensile strain is 12 to 17 kilograms per square millimeter (mean 9 tons per square inch), and its elongation from 12 to 6 per cent., according to the proportion of the two metals. When rolled, the density of partinium is 3.09; its resistance to tensile strain from 32 to 37 kilograms per square millimeter (mean 22 tons per square inch), and its elongation from 8 to 6 per cent.

In all the above named applications, for brass and gun metal there is substituted an alloy which has only half their weight with one-third greater resistance; and the cost of a part merely cast is no greater whether it be of gun metal or partinium, while that of a finished part is even less when made of the latter metal. Rolled partinium is now used for the bodies of motor cars, lending itself to any required form; and a body made of this alloy, mounted on a frame built of angle bars, with roof of sheet partinium, constitutes a metallic whole which, for equal strength, weighs from 50 to 60 per cent. less than one made of wood, while with certain precautions it can receive the same painting as the best finished carriage. The first partinium car body dates from 1898, and this use of the alloy has since become general. Now that crushing strain tests have shown that this metal can stand a compression strain of 38.2 kilograms per square millimeter (24 tons per square inch) without deformation, it has been largely used for making portable houses.—The Automotor Journal.

## The Bordeaux-Perigueux Race.

Very great interest was manifested in this race, for it is long since a *course* for the big cars has been held; and, furthermore, it was known that several of the new types of racers would be making their maiden trials in this event. For a week or two prior to the race motormen had keenly discussed the possibilities of exceptional performances, and the opinion universally expressed was that something altogether extraordinary might safely be anticipated. And this surmise has proved absolutely correct, for the times made by the leading cars on the first day, when the race was contested over 116 kilometers of ideal road, were truly wonderful. First of all we had Levegh, who, mounted on his new Mors racer, actually covered the 116 kilometers in 84 m. 35 s., or at an average speed per hour of 82½ kilometers (51½ miles). Then came Giraud, driving this year's racing Panhard, of the type which will be employed in the Gordon Bennett contest next week, and his time was but 2½ m. slower than that of Levegh. Bostwick, who was third, was mounted on De Knyff's "Tour de France" car, which, as reported in these columns some few weeks ago, he bought at a very high figure. This was the American's maiden race in Europe, and it speaks volumes for his pluck and skill to have secured such an excellent place in the official list. His time for the distance was 91 m. 43 s., showing an even better average than that made by De Knyff with the same car at Pau, which hitherto has been regarded as the fastest average made in a race. It is true the Pau course was considerably longer, but Bostwick's performance was certainly an eye-opener for those critics who had left the car out of their calculations on the supposition that the new owner had not had sufficient experience to be well placed. Maurice Farman, who was next on the list, drove a new Mors, but the third Mors representative, Antony, did not succeed in finishing. The times on the second day were not nearly so fast, for the hills of Périgueux at Angoulême had to be negotiated, in addition to a long stretch of block pavement extending from Montlieu to Saint-André-de-Cubzac. Still, the foremost cars averaged somewhere in the vicinity of 70 kilometers per hour for the 202 kilometers of route!

The official classification for the two days was as follows, the total distance being 318 kilometers:

Two-seated cars—1, Levegh, 4 h. 9 m. 45 s.; 2, Giraud, 4 h. 12 m. 36 s.; 3, Bostwick, 4 h. 20 m. 6 s.; 4, Farman, 4 h. 44 m. 7 s.; 5, Secrestat, 5 h. 23 m. 34 s.; 6, Barrow, 5 h. 36 m. 54 s.; 7, Champrobert, 6 h. 31 m. 23 s.; 8, Versein, 6 h. 38 m. 52 s.

Four-seated cars—1, Maurel, 6 h. 22 m. 22 s.

Two-seated cars (8 h.p.)—1, Gondoin, 7 h. 26 m.

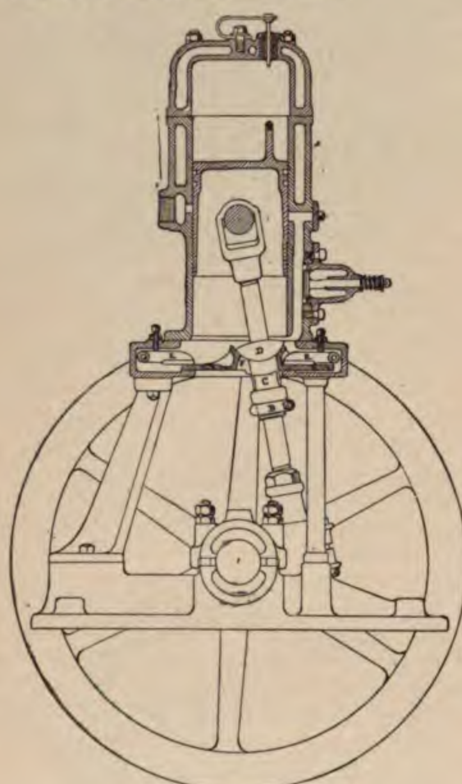
The official classification of the categories following the shorter route of 260 kilometers was as follows:

| Cars (6 h.p.)— | h. | m. | s. |
|---|---|---|---|
| 1. Lafitte | 6 | 9 | 17 |
| 2. Mauzan | 6 | 10 | 12 |
| 3. Gateuil | 6 | 50 | 51 |
| Cars (six seats)— | | | |
| 1. Lefebvre | 6 | 6 | — |
| Voiturettes— | | | |
| 1. Théry | 4 | 40 | 17 |
| 2. Camus | 6 | 16 | — |
| 3. Schmidt | 7 | 5 | 49 |
| 4. Cornilleau | 7 | 19 | 29 |
| 5. Bord | 8 | 37 | — |
| Tricycles— | | | |
| 1. Cormier | 4 | 26 | 39 |
| 2. Jourde | 4 | 31 | — |
| 3. Joyeux | 4 | 33 | — |
| 4. Chrétien | 4 | 34 | 36 |
| Quadricycles (two seats)— | | | |
| 1. Lafargue | 5 | 44 | 46 |
| 2. Barreau | 6 | 14 | 14 |

—Motor Car Journal.

## Some Novel Gas and Steam Engines.

Henry R. Stickney, of Portland, Me., has been experimenting with the two-cycle gas engine shown in external view and section in the cuts below. As will be seen, the lower end of the cylinder is inclosed to act as a pump, and the cranks are not inclosed. This is done without the use of a crosshead, by means of a sort of movable stuffing box. The sleeve C D, in the sectional view, works in a sliding plate, F, which closes the end of the cylinder and is held to its seat by the screw-adjusted gibs E E. The gib or lug C, adjusted by the nut B, holds the sleeve from following the connecting rod in its upward movement.

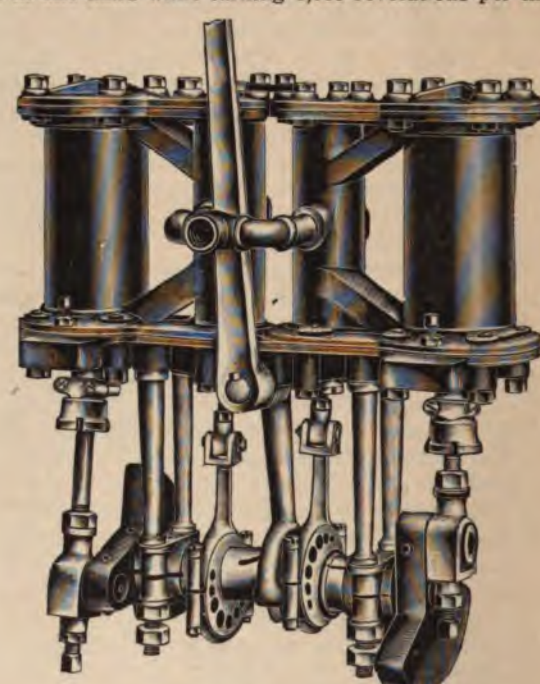


STICKNEY OPEN CRANK GAS ENGINE.

Mr. Stickney tells us that his gas engine is not yet beyond the experimental stage, but he has built a number of successful small steam engines on the same principle, which are shown in the accompanying external view. Their construction is practically the same, except that the pistons have double heads and the slide F is thicker, so as to reduce the clearance and avoid the waste of steam. The gibs E, E and C are retained, though the steam pressure relieves the former of most of their duty. No packing is considered necessary around the connecting rod in the gas engine, but a stuffing gland is added in the steam engine, as is plainly shown in the illustration. The adjusting nut B in the steam engine is split at the top end and clamps the sleeve, while it acts both for adjustment of gib C and as a stuffing box, its lower end being enlarged, threaded and recessed for this purpose.

To reverse the steam engine, the eccentrics are keyed to a sleeve, which is rotated to the backing position by means of a spiral groove in the shaft.

The compactness of this construction, and the saving of weight, vibration and wear by getting rid of the crosshead and piston rod, are evident advantages of this construction. Mr. Stickney informs us that the steam engine can easily be held in one hand while turning 1,000 revolutions per minute.



STICKNEY STEAM ENGINE.

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The utilization of blast furnace gas in gas engines is being largely developed on the Continent. From statistics of gas engines using this source of power, given in a contemporary, we learn that there are in Germany 41 engines, aggregating 21,950 h.p.; Luxemburg, 12 engines, aggregating 6,760 h.p.; Belgium, 8 engines, aggregating 3,700 h.p.; France, 8 engines, aggregating 3,250 h.p.; and England, 6 engines, aggregating 2,060 h.p.

## MINOR MENTION.

The Triumph Motor Vehicle Co., of Chicago, has been incorporated. Capital, $300,000.

The New York Motor Vehicle Co. has been chartered in New Jersey. Capital $500,000.

Newport has added 10 days in jail to the other penalties provided for overspeeding in the public streets.

The National Automobile & Electric Co.'s plant, Indianapolis, Ind., was started last week with a force of 40 men and boys.

D. D. Mott of Passic, N. J., has nearly completed a steam vehicle to the order of the Paterson Wagon Co, of Paterson, N. J.

The new electric ambulance of St. Vincent's Hospital, New York, has been put into service. It was presented to the institution by Edward Kelly, son of the late banker.

An ordinance has been passed in Newport, R. I., restricting the speed of motor vehicles in that city to six miles an hour in the business section and ten miles an hour in the outer portions.

Edwin J. Farber, of Baltimore, recently entered Druid Hill Park, of that city, in his gasoline carriage. He was arrested and will take the case to court to test the constitutionality of the Park Board's ruling.

The Nassau County (L. I.) Supervisors are receiving many complaints about the high speed at which motor carriages are run there, and it is probable that an attempt will be made before long to enact a speed limit.

The automobile recently imported by W. K. Vanderbilt, Jr., which has occasioned so much excitement in Newport by its high speed, is reported to be a Daimler, and to have a 30-h.p. motor. The actual power is probably less. A French mechanician is in charge of it, and Mr. Vanderbilt himself does not attempt to run it.

After a trial lasting two days the jury disagreed in the suit of Emily Coon vs. the N. E. Electric Vehicle Transportation Co., which was a suit to recover $25,000 for personal injuries sustained by plaintiff by being run into by an electric cab on Dartmouth St., Boston, Nov. 2, 1899. The case was tried in the U. S. Circuit Court, before Judge Putnam and a jury.

The following committees have been named by the Rochester, N. Y., Automobile Club: Membership: Joseph J. Mandery, chairman; C. J. Conolly, Frederick Sager. Auditing: C. M. Everest, chairman; James S. Watson, Dr. E. J. Bissell. Tours and runs: F. H. Bettys, chairman; J. H. Sager, Park Densmore. Ordinance: George Eastman, Dr. W. A. Keegan, George Foster.

The Electric Vehicle Co. intends to increase its capital stock from $12,000,000 to $18,000,000, divided equally between common and preferred stock. The chief purpose of this issue is to take over the half interest in the Columbia & Electric Vehicle Co., which is now owned by the Columbia Automobile Co. The Electric Vehicle and the Columbia Automobile Cos. have been half owners of the Columbia & Electric Vehicle Co., the manufacturing concern, and it is proposed to put all of the manufacturing business directly in the hands of the Electric Vehicle Co.

MM. Clement, of Levallois, Paris, are manufacturing a light voiturette for two persons, having a 2¼-h.p. air-cooled motor with two-speed gear. The motor is under the seat, whose sides are made perforated for access of air. Steering is by a sloping hand wheel, in proximity to which all the control levers are located. The carriage is said to be capable of a speed of 30 kilometers (18 miles) an hour, and weighs only 300 lbs.

Professors R. W. Wood and Joseph Jastrow, of the University of Wisconsin, rode in a locomobile from Milwaukee to Madison, Wis., on the 8th of this month, covering the 85 miles in 5½ hours. So far as known this is the first long-distance trip made in Wisconsin. The rubber packing of the steam chest blew out en route, but a substitute pro tem. was found in a washer cut from the rubber covering of the carriage step.

A Philadelphia paper is offering a steam carriage as a prize to the winner of a puzzle series in its columns. It was recently run from New York to Philadelphia in 7 hours and 7 minutes net time over the route chosen by the Automobile Club of America for their Philadelphia run. The net time thus made was reckoned by deducting from the total (8 hours 23 minutes) the time spent on the two Staten Island ferryboats.

The Carse Bros. Co., 64-66 Wabash Ave., Chicago, send us a description of their acetylene searchlight. The generator is very simple, consisting merely of a water tank in which is immersed a porous jar containing the carbide. The reflector is mounted on an adjustable standard, and contains the burner, which is connected by a rubber hose to the top of the generator. The reflector is quite large, and it is claimed that the face of a watch may be read at one-quarter of a mile distance by the light thrown. The flame will not blow out in a strong wind.

## Involuntary Pacemaking.

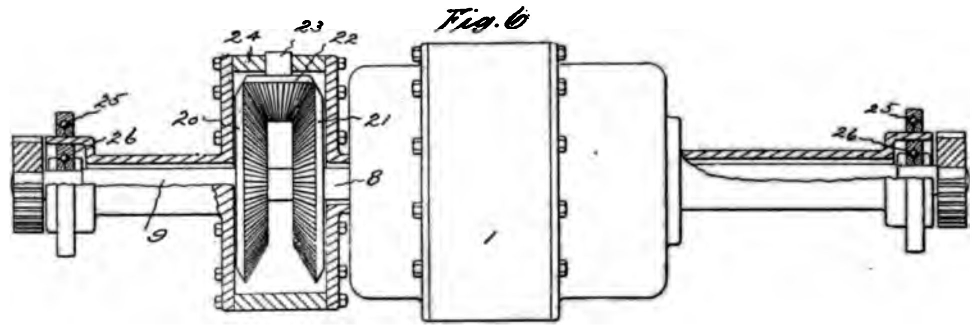
A motor carriage at high speed makes an ideal pacemaker, and bicyclists have not been slow to find this out. An English wheelman followed the recent 1,000-mile trial clear through by sticking close to one or another of the large machines, and thought nothing of the feat. Now the Washington papers report that the persistent dogging of automobiles in that city by unmannerly bicycle riders has become a pronounced nuisance, several wheelmen often following a single carriage, suiting their pace to that of the carriage, and refusing to leave it.

The Washington Post reports the intention of a recent steam carriage purchaser to fit his vehicle with a multiple blow-off pointing backward, which would at least keep the parasites at a somewhat respectful distance. Users of electric or gasoline carriages, however, would have to find some other defense, and the Post suggests a shotgun loaded with coarse salt. The mounted police have been instructed to give attention to the matter.

# MOTOR VEHICLE PATENTS of the world

## UNITED STATES PATENTS.

650,837—Balance Gearing for Automobiles.—H. E. Heath, of Windsor, Conn., assignor to the Eddy Electric Mfg. Co., of same place. June 5, 1900. Application filed Jan. 2, 1900.

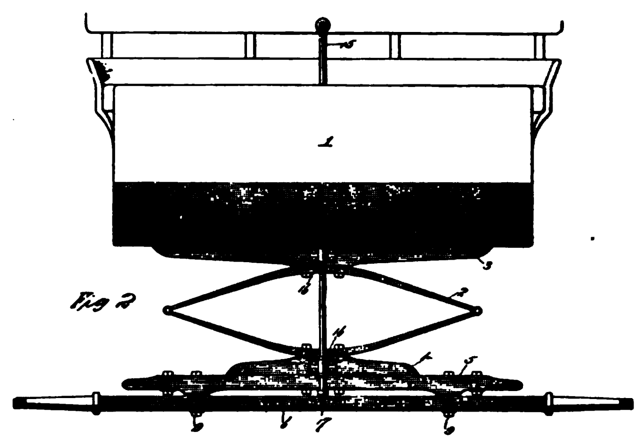



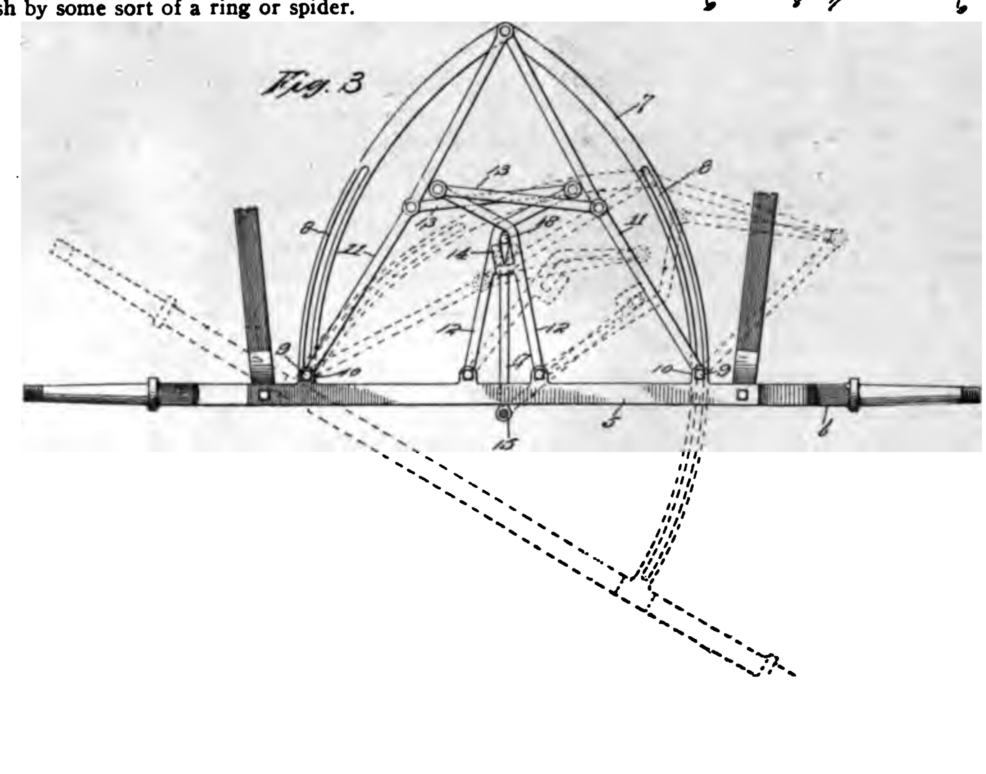

No. 650,837.

The object of this invention is to render exact alignment unnecessary between the motor shaft and the shaft carrying the differential, which in this invention is supposed to be substantially concentric with the motor shaft. Fig. 2 illustrates one method of accomplishing this when spur gears are used in the differential; 8 is the axle, and 3 is the motor shaft, which is hollow and bored larger than the axle. An arm, 5, is carried on the shaft 3, and a link, 6, connects the end of the arm with the pinion stud. In Fig. 6 bevel gears are used, and the pinion 22 has a shank, 23, running in a bearing, 24, and free to slip axially to accommodate itself to any lack of alignment between the motor shaft (which carries the differential drum) and the axle 8, 9. The arrangement appears to be defective in that the pinion or pinions 22 will naturally move radially outward as far as the bearings will let them, unless held in mesh by some sort of a ring or spider.

650,838—Steering Mechanism for Automobiles.—H. E. Heath, of Windsor, Conn., assignor to the Eddy Electric Mfg. Co., of same place. June 5, 1900. Application filed Jan. 2, 1900.

The purpose of this invention is to lock the steering gear in its straight-ahead position. This is accomplished by the slotted bows, links and toggles shown. The steering rod 15 carries the arm 17 at its lower extremity, and this arm has a finger, 18, engaging one or the other of the bent bars 12, 12, which act on the toggle joints 11, 11 in the manner shown by the dotted lines. Either the right or the left hand pin 9 is the pivot about which the front axle swivels, according to the direction in which the vehicle is to turn. No apprehension is suggested as to the possible sagging or collapse of the body from the change in its point of support.



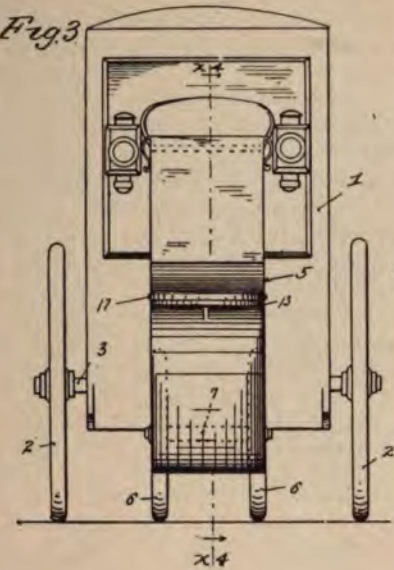


Fig. 3

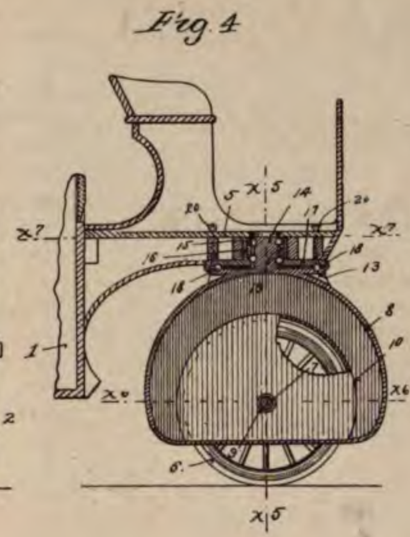


Fig. 4

650,816—Motor Vehicle.—C. E. Belcher, of Linden, Pa., assignor of one-half to J. H. Bowers, of Jersey Shore, Pa. June 5, 1900. Application filed Dec. 21, 1899.

650,847—Automobile Delivery Wagon.—H. W. Libbey, of Boston, Mass. June 5, 1900. Application filed Oct. 2, 1899.

A wagon supposed to be driven by jets of air (compressed or liquid) impinging on vanes or buckets attached to the rear wheels. There is no provision for supplying heat to the air to make up for that lost by expansion.

650,893—Automobile.—L. S. Buffington, of Minneapolis, Minn. June 5, 1900. Application filed Nov. 13, 1899.

A fore-carriage, housed in the manner shown, and having two wheels rigid on one shaft. The fore-carriage is pivoted in the manner shown, with ball bearings, and may be driven by any suitable motor.

650,906—Motor Wheel.—Edwin Perks, of Coventry, England. June 5, 1900. Application filed Feb. 5, 1900.

This is a wheel with a motor inside of it, the motor being stationary and the wheel revolving around it. The crank shaft is below the axis of the wheel and carries a pinion meshing with an internal gear attached to the wheel. At the

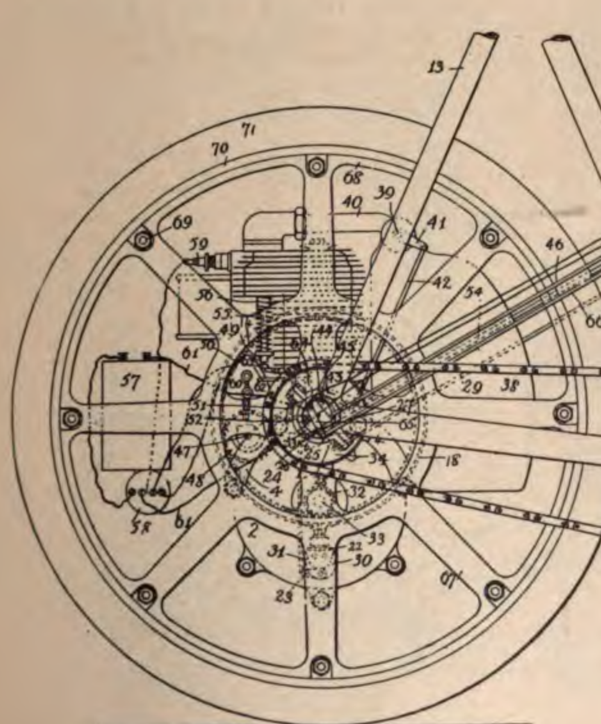


FIG. I.

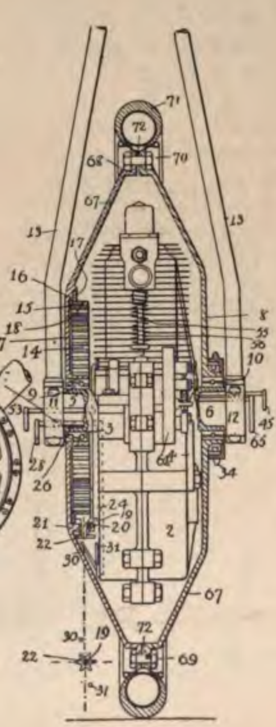


FIG. II.

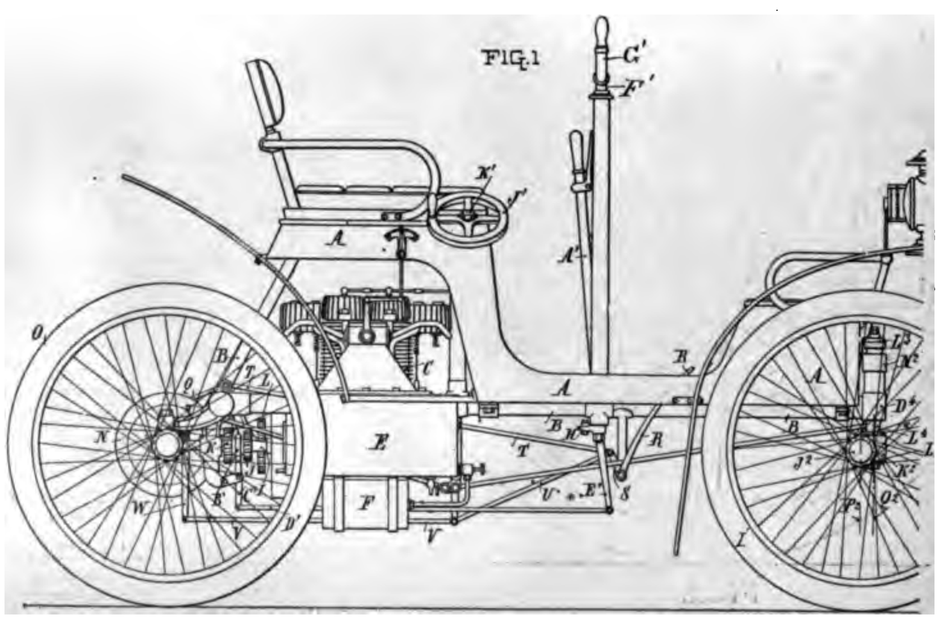
axis of the wheel are two trunnions, 5 6, projecting from suitable brackets, one on each side of the crank case, and these trunnions pass out through the wheel hubs and are secured to the frame by the halved clips or straps 11 12. Ball bearings are formed on the outside of the trunnions, and these carry the wheel hubs in the manner shown. The trunnions are hollow, and through them pass the means for controlling the mixture, ignition, etc., said means consisting of rocking stems carrying fingers at their inner and outer ends, the outer ones being connected by rods to the levers under the operator's hands. Suitable blocks within the trunnions afford a bearing to the rocking stems.

The internal gear 14 is not made fast to the wheel, but has a flange, 16, covered by a retaining ring, 17, so that the gear is free to revolve independently of the wheel. Connection between the two is established by means of a brake ring, 18, around the gear, which is arranged to be tightened by a rocking lever passing through the trunnion 5. Instead of placing the two-to-one gear at the side, lateral room is saved by using a pinion, 48, of double the pitch diameter of the pinion 32 on the crank shaft, and likewise in mesh with the internal gear. From this the exhaust valve and spark make-and-break are operated in the usual manner. The carbureter 38, the battery 57 and the other accessories are preferably mounted inside the wheel and attached to the motor. A separate rim, 72, is clamped between the two halves 67 of the wheel, and by removing the halved clips 11 12 and disconnecting the controlling levers, the wheel and motor may be removed bodily, when the removal of one-half 67 will leave the motor exposed. A sprocket wheel, 34, is provided for starting the machine by pedaling.

650,950—Motor Vehicle.—L. W. Ravenez, of Paris, France, assignor to the Société Nouvelle des Etablissements Decauville Ainé, of same place. June 5, 1900. Application filed March 3, 1898.

Fig. 1 is a longitudinal elevation, partly broken away, of a motor vehicle, according to this invention. Fig. 3 is a partial plan showing the motor and accessories. Figs. 4, 5, 6 and 7 are detail views, being respectively a longitudinal elevation, a plan, and cross-section of the construction of framing and steering gear and method of suspension. Figs. 8, 9 and 10 are views of details on a larger scale, Fig. 8 being a section on the line v x of Fig. 10 and Fig. 9 a section on the line y z of the same figure, while Fig. 10 is a plan view of the device for the gearing for effecting variation of speed as well as of the brake device of the same.

The carriage frame is arranged to rest on the longitudinal member B, the construction of which will be hereinafter described, and below it are arranged, also supported by the said longitudinal member B, the motor C, with all its accessories, such as the petroleum reservoir D, the carbureter E and the exhaust silencer F, as well as the gearing for actuating the rear wheels of the vehicle from the motor. This actuating mechanism comprises a coupling disk, G, actuated by the shaft H of the motor and acting as a fly wheel to the said motor. This disk consists of two parts, $g$ $g^2$, of which one, g, is concentrically fixed on the shaft H and is provided with a crown or ring, g', secured to it, the inner side of the latter being conically shaped so as to correspond with the periphery of the second part $g^2$, which is likewise conically shaped and comprises a plate, $g^3$, resting freely with its center on the end of the shaft H and capable of sliding longitudinally on it. The plate $g^3$ is fixed to the end of a shaft, I, in line with the shaft H, and can revolve in the support $g^4$. The shaft I is provided with a sleeve, B', which can slide longitudinally on it, but is fixed to it as regards the rotary movement of the shaft I, say by a key. On this sleeve B' are arranged pinions, J and K, of different diameters, for transmission of movement and change of speed. The sleeve B', moreover, is provided with a collar, b, which by means of levers, C', D' and E', actuated by the hand lever A', can displace the sleeve B', and with it the pinions J.K, so that one or the other of the latter will, according to the speed desired, gear with the corresponding pinions L $L^2$, keyed on the shaft M, arranged parallel to the shaft I and carried in bearings m m', conveniently attached to the longitudinal frame of the vehicle. The shaft M is also provided with a conical toothed pinion, n, which transmits by means of a bevel wheel, p, the movement to the axle g, on which is arranged a differential gear device for facilitating the turning of the vehicle,



which device is contained in a drum, N, rigidly fixed to the bevel wheel p. The rear driving wheels O of the vehicle are fast with the axle q and so partake of its rotation in either a forward or backward direction.

On the outside of the drum N are arranged two brake bands, P and Q, actuated independently of each other by a system of levers and connecting rods, s t, which in turn are actuated by two pedals placed side by side and arranged at the bottom of the carriage, so as to be easily worked by the feet of the driver of the car. The band Q acts along and is actuated by a pedal (not shown) in case a simple reduction of speed is required, while the band P is actuated by the pedal R in combination with the friction gearing G when a sudden stoppage is required. For this purpose the engagement or disengagement of the two parts g and g² of the friction device G is effected by means of the longitudinal displacements in one or the other direction of the shaft I, which movement is effected by means of a lever, W, pressing below its point of suspension, W′, on a bolt, W², pivotally mounted at

FIG. 8

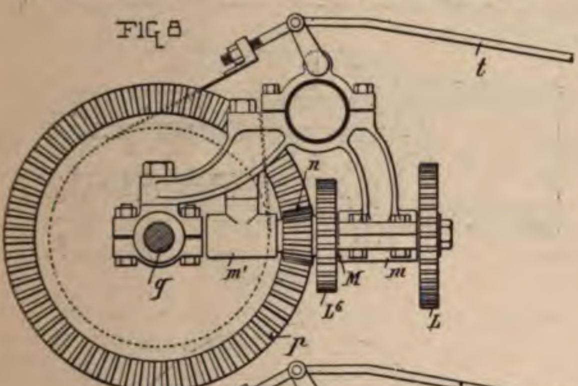


FIG. 9.

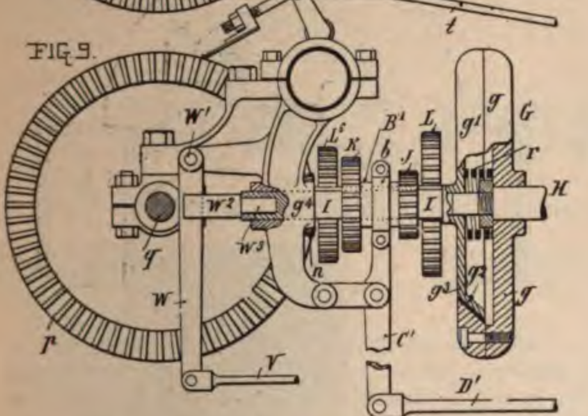
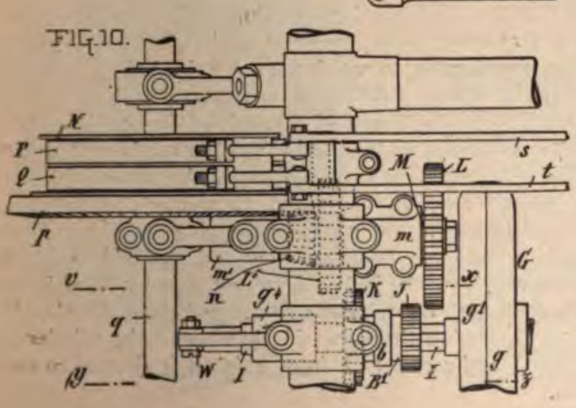


FIG. 10.

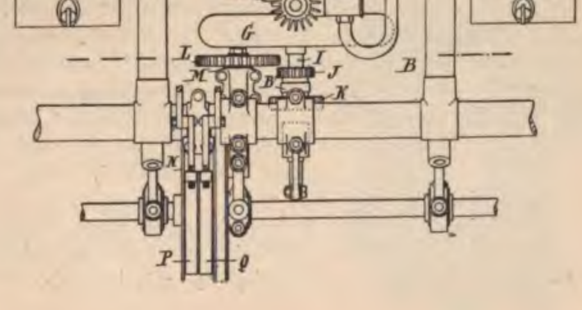


W² on the end of said shaft and actuated by the rod V, connected by a convenient system of levers with the pedal R in such a manner that when the brake band P is actuated by means of the said pedal the disengagement of the friction device is obtained, while the engagement is effected by the action of the spring r between the two plates g and g². Within the reach of the driver is also the handle bar G′ on the top of the steering rod F′, the lower end of which is provided with an arm, H′, operating the front steering wheels I′, as will be hereinafter described; also, the starting hand wheel J′, which when turned causes its spindle K′ to turn, said spindle carrying at its lower end a bevel pinion, L′, engaging with a corresponding pinion, M′, combined with a pawl gear, N′, keyed on the front end of the shaft H of the motor, and, finally, a small handle for operating pressure cocks, O′, of the cylinders of the motor; and these small levers are adapted to be held in variable positions on notched and graduated segments, said levers controlling respectively the proportions of the explosive mixture by means of the cock P′, the admission of the charge to the motor by means of the double cock Q′, and the retarding or accelerating of the ignition by means of an electric device producing a spark in the explosion chambers.

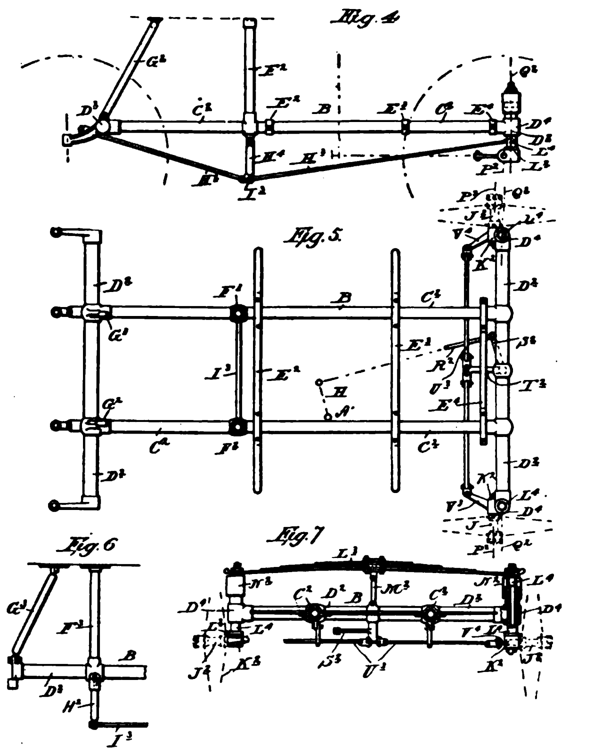
The motor C has two cylinders, R² S², each comprising a valve chest, explosion chamber, electric igniting device and the usual accessories. The bed plate or casing of the motor consists of two symmetrical parts secured together and forming a box, T′, supporting the cylinders. This box or casing completely incloses the cranks and fly wheels and is secured by means of lugs or projections, U′ V′, to the framing B by means of collars, U² V², secured to the longitudinal members of said frame. On each side of the motor C are symmetrically arranged (also supported by the collars U² V²) an oil tank, D, and carbureter, E, supplied from the former.

The framing B, made preferably of steel tubing, is constituted by two parallel longitudinal members, C², connected at each end by transverse members, D², carrying the axles or journals of the wheels by means of suitable bearings and sockets.

FIG. 3.



Intermediate transverse bars, $E^2$ $E^3$ $E^4$, as well as vertical uprights, $F^2$ $F^3$, and inclined uprights, $G^2$ $G^3$, serve to support and fix the body of the carriage. Ties $H^2$ $H^3$, with stays, $H^4$, are combined with each longitudinal member $C^2$ for the purpose of strengthening and increasing the rigidity of the frame B. The stays $H^4$ are connected at their lower ends by a cross stay, $I^2$, insuring and completing the rigidity and strength of the whole.



The front wheels I′ are carried by the front transverse rod $D^2$ of the frame B, provided for this purpose with vertical sockets, $D^4$, at their ends. The axles $J^2$ of the wheels are held horizontally in sockets, $K^2$, provided with a vertical spindle, $L^4$, passing through the sockets $D^4$ with a slight amount of friction. The lower ends of these spindles form, near the sockets $K^2$, shoulders, $L^2$, their upper ends projecting beyond the sockets $D^4$, being respectively attached to corresponding ends of a laminated suspension spring, $L^3$, attached at its center to the fixed cross bar $D^2$ of the frame B by means of a rod, $M^2$. The guiding and support of the spindles $L^4$ are completed by means of caps, $N^2$, at their upper ends adapted to slide over the upper portion $O^2$ of the sockets $D^4$, which they serve as a cover.

To insure complete stability of steering—that is to say, to render it insensible to shocks which in motor vehicles of the usual construction compel the driver to hold the steering handle securely and continuously—the handle operating the steering rod, the axes $P^2$, Fig. 5, of the journals of the front wheels and the axes $Q^2$ of the corresponding spindles $L^4$ are arranged in different vertical planes, as may be seen in Figs. 1, 4 and 5, where the axis $P^2$ is nearer the center of the frame B than the axis $Q^2$.

The steering is effected by means of hinged levers, $R^2$ $S^2$ $T^2$ $U^2$, Fig. 5, these latter levers $U^2$ being connected to rods $V^3$ $V^4$, secured to the sockets supporting the axle journals.

# BRITISH PATENTS.

5089 of 1900—Gas Engine.—Alf. Dougill, of Leeds.

This invention has for its object the construction of gas and other explosion engines in such a manner that the end of the piston exposed to the explosions of gas and air is retained at a lower and more even temperature than at present obtains in engines fitted with the ordinary construction of piston.

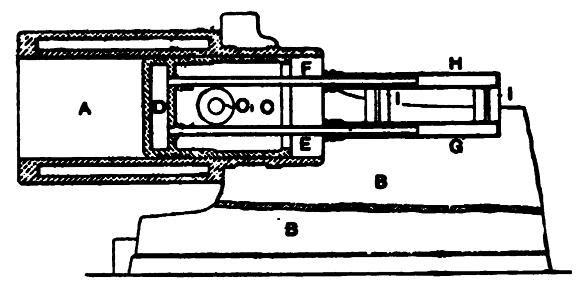


FIG. 1.

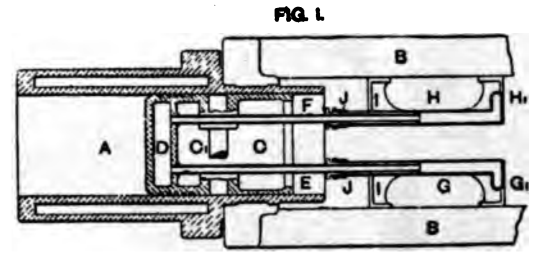
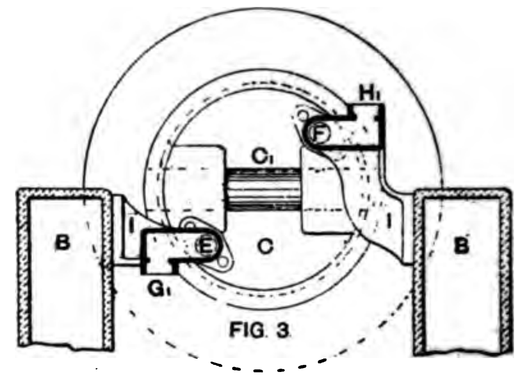


FIG. 2.




The method by which this is accomplished is shown by the accompanying illustrations (Figs. 1, 2 and 3). Referring to these it will be seen that the piston C is provided with a journaled crossbar, $C_1$, for receiving one end of the connecting rod as usual. The inner end of the piston C is provided with a chamber, D, to which are secured tubular connections, E and F. These tubular connections extend into the respective receivers G and H secured to the bed plate B, the receiver G having an inlet at $G_1$, and the receiver H an outlet at $H_1$. The receivers G and H are in the same axial line as the tubular connections E and F, and are provided with stuffing boxes, J. The water for keeping the piston C comparatively cool may be drawn from and returned to the same source, supplying the jacket K around cylinder A, and caused to flow through the tubular connection E into chamber D in piston C. passing through said chamber to the tubular connection F and receiver H, from which it is allowed to escape at $H_1$.

**PARKER & BURTON,**

## Patent Causes and Patent Soliciting.

**DETROIT, MICH.**

Pamphlet, "GAS ENGINE DESIGN," by E. J. Stoddard, SENT FREE FROM ABOVE ADDRESS.

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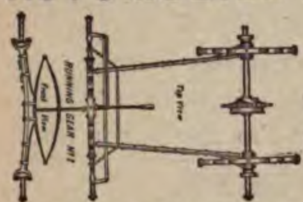
## AUTOMOBILE RUNNING GEARS.



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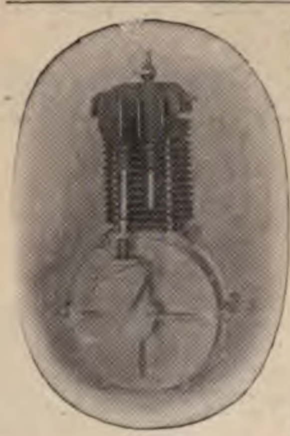

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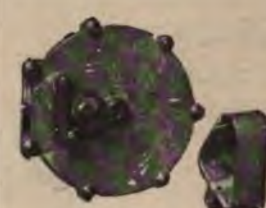

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VOLUME VI | NEW YORK, JUNE 27, 1900 | NUMBER 13

# THE HORSELESS AGE.

E. P. INGERSOLL, EDITOR AND PROPRIETOR.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

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THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post office as second-class matter.

*On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.*

THE HORSELESS AGE appears in a new dress of type this week, and we think our readers will appreciate the change.

## GET TOGETHER!

THE latest move of the Lead Cab Trust is to attempt, by acquiring the George B. Selden patent of Nov. 5, 1895, to control the gasoline vehicle industry. On the strength of the supposed broad and fundamental claims of this patent they have called upon the leading builders of gasoline vehicles to stand and deliver, and are undertaking to dictate terms of peace.

The Selden patent was described and illustrated in THE HORSELESS AGE in December, 1896, and its claims there given in full. As the now antiquated document has been galvanized into new life by its present possessors, we reprint the claims in another column. The vehicle described in the specifications is impractical in almost every detail and fanciful in the rest. The motor is mounted on the front axle, steering is by fifth-wheel, and reversing by swiveling the fifth wheel half around; transmission is by single reduction with no speed changes, and the clutches are of the ratchet type, one on each front hub, no differential being suggested; and the motor itself is merely ridiculous.

The patent virtually stands or falls by its first claim, and this, stripped of legal verbiage, merely claims the combination of a gasoline engine, a clutch, and a steerable running gear, "substantially as described." The "power shaft connected with and arranged to run faster than the propelling wheel" is beside the point. As gasoline engines are now known, nothing else would be possible. Whether there ever was or could be any patentable novelty in the combination of a gas engine with a running gear is a matter for the courts to decide. Whether the inventor ever expected to build such a vehicle is a question. Evidently it was not built when the patent application was filed. Whatever strength the claims possess will lie in their being extended, to the ignoring of the specifications, to cover the combination of any suitable form of hydro-carbon engine with any suitable form of wagon, and connected thereto by any suitable mechanism.

THE HORSELESS AGE has received letters from a number of leading manufacturers expressing a willingness to unite in an association for the purpose of contesting the patent. Every bona-fide manufacturer should join them, and dispose once and for all of this and future attempts to throttle the industry.

## A GENTLE PLAINT.

AUTOMOBILING has been added to the other fashionable amusements at Lenox. In spite of ordinances passed by the town councilmen, restricting speed to eight miles an hour and imposing fines, the autos, gasoline, steam and tricycles, go tearing about the Berkshire roads at a breakneck speed. The Lee, Mass., *Gleaner* publishes the following pathetic letter from a Lenox resident, apparently of the gentler sex:

"DEAR GLEANER:

"Should not summer-resort towns like Stockbridge and Lenox forbid automobiles? The prosperity of such towns depends upon the city visitor—either those who come for health or pleasure, or for both reasons. The presence of automobiles is a menace to both classes. From an experience of two seasons in Lenox it is evident that the presence of automobiles makes it impossible for people to drive about with horses with safety at any time, and the great attraction of a summer in

Lenox or Stockbridge is undoubtedly driving along their beautiful village streets and country roads, enjoying in peace and comfort the fresh air and the rural sights, and sounds, and odors.

"The automobile has put a sudden and painful stop to all such happiness. With richer and poorer the same apprehension is felt. The trolley is not to be mentioned in the same breath with the automobile as a source of danger and discomfort. The trolley car travels at regular hours and on a fixed track, while the automobile darts about in every direction at all hours and on all roads. There is no possibility of escaping it, whatever precautions one takes. The trolley, moreover, is driven by a trained motor man, while the automobile is driven by any man, woman or child, however unskilled. The trolley car is limited to a certain moderate speed, while the automobile is absolutely lawless. They have been darting about the streets and roads of Lenox day and night at the rate of 25 or 40 miles an hour.

"Everyone is in constant fear. The laboring man driving to and from his work, the market woman with her milk and eggs, the teamster with valuable loads, the doctor on his daily rounds, the convalescent driving out to recover health and strength, the rich man or woman on horseback or with a break or four-in-hand, or the child and pony wagon, all have been terrorized by the reckless and inconsiderate automobilist.

"The summer visitor is hesitating about bringing or hiring horses for fear of the automobile. It is reducing the business of the livery man, of the farmer, of the boarding-house keeper.

"One of the great charms of Lenox and Stockbridge has been the quiet drives they had, free from railroads and trolleys and tramps; the prosperity of these towns depends upon preserving them. That is why the trolley was opposed even on one stated highway. Shall we allow the automobiles to invade, pervade and ruin all of our highways? We have the power to stop them. Let us do so before our guests are driven away to towns that do prohibit them. "Y."

A scurrying automobile is certainly not in keeping with the repose of a Berkshire landscape, and although "Y.'s" letter is somewhat amusingly overdrawn no one will refuse to sympathize with the protest of its author. But perhaps when motor vehicles become commoner they will cease to be the most conspicuous feature in any scene that includes them. Telegraph po'es and railway tracks are not beautiful, but they no longer obtrude themselves on the tourist's vision as marring the landscape.

THE increasing interest in good roads, manifested in the letter published in another column, is most encouraging. The gathering referred to ought to lead to important results, and we bespeak for it the support of all who are able to further its success.


EDWARD S. CLARK STEAM DELIVERY WAGON.

## CLAIMS OF THE SELDEN PATENT.

(1) The combination with a road-locomotive, provided with suitable running gear, including a propelling wheel and steering mechanism, of a liquid hydro-carbon gas engine of the compression type, comprising one or more power cylinders, a suitable liquid fuel receptacle, a power shaft connected with and arranged to run faster than the propelling wheel, an intermediate clutch or disconnecting device and a suitable carriage body adapted to the conveyance of persons or goods, substantially as described.

(2) The combination with a road-locomotive, provided with suitable running gear, including a propelling wheel and steering mechanism, of a liquid hydro-carbon gas engine of the compression type, comprising one or more power cylinders, a suitable liquid fuel receptacle, a power shaft connected with and arranged to run faster than the propelling wheel, an intermediate clutch or disconnecting device, and a suitable carriage body located above the engine, substantially as described.

(3) The combination with a road-locomotive provided with suitable running gear, including a propelling wheel and steering mechanism, of a liquid hydro-carbon gas engine of the compression type comprising one or more power cylinders, a suitable liquid fuel receptacle, a power shaft connected with and arranged to run faster than the propelling wheel, an intermediate clutch or disconnecting device, a suitable carriage body located above the engine and a flexible or jointed connection between the engine and the body, substantially as described.

(4) The combination with a road-locomotive, provided with suitable steering mechanisms, of a hydro-carbon engine applied to the driving axle and having flexible valve or clutch connections located within the steering mechanism, substantially as described.

(5) The combination with a road-locomotive provided with a propelling wheel, of a liquid hydro-carbon gas engine of the compression type, comprising two or more working cylinders and pistons arranged to act in succession during the rotation of the power shaft, a suitable liquid fuel receptacle, suitable devices for transmitting motion from the power shaft to the driving axle, and a clutch or disconnecting device, substantially as described.

(6) The combination with a road-locomomotive, provided with a propelling wheel, a liquid hydro-carbon gas engine of the compression type, comprising one or more unjacketed working cylinders communicating with a closed crank chamber, adapted to hold a cooling liquid, and a power shaft geared to run faster than the propelling wheel, substantially as described.

GEORGE B. SELDEN.

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## EDWARD S. CLARK STEAM DELIVERY WAGON.

We illustrate herewith a steam delivery wagon built by Edward S. Clark, 272-278 Freeport street, Boston, for J. G. and B. S. Ferguson, bakers, of Boston. The following are the leading particulars regarding it: Weight of vehicle fully equipped and ready to run, 1,750 pounds; wooden wheels, 32 and 36 inches in diameter, with 1¾ inches solid rubber tires. The engine is of the Clark two-cylinder double-acting reversible type, and the boiler is of the fire tube type and capable of developing 8 h. p. The frame of the vehicle is made flexible, to allow for inequalities in the road surface. The brake is operated by a pedal, and the wagon is manipulated by two handles—one for steering and the other for regulating the throttle and reverse motion of the engine. The operator may sit on either side. The wagon has been in daily service for some time, and will climb heavy grades over rough country roads.

## EVOLUTION OF THE MOTOR VEHICLE AS SHOWN BY PATENTS.

### PART IV.—THE SPEED-CHANGING GEAR.

BY LEONARD HUNTRESS DYER.

With but one or two exceptions, all of the patented motor vehicles of the last century and the first half of the present one were propelled by steam.

As steam was practical, flexible and capable of a momentarily great increase of power to overcome obstacles in the road, there would apparently be no particular need of speed-changing devices and none should be found in the genesis of the art. This, however, is not true.

The great majority of the early motor vehicles, if the patents granted have any bearing on the actual number used, were provided with some form of mechanical speed-changing device, sometimes simple, and no doubt inefficient, and at other times complicated and probably equally unsatisfactory in practice.

Aside from the directly coupled engine the earliest transmission medium is the endless chain. By providing two such chains, in connection with gears of different relative diameters, and with some means for "cutting out" either chain, a practical two speed gear would result. This "cutting out" seems to have been effected in a number of ways. Three are shown in as many different patents. The first employs several pairs of endless chains, which are normally slack. Any desired one may be tightened by a jockey pulley. The sprocket wheels would necessarily have to be deeply grooved, and the welps would have to be shallow to allow the slack chains to travel with a minimum of friction. It was no doubt noisy in operation.

A second, and very common construction, was to employ several endless chains stretched tightly around the sprockets. The latter were connected to their supporting shafts by clutches.

An ingenious modification of the latter construction shows two endless chains passing around sprockets on the engine shaft, the bight of one chain engaging with a sprocket on the driving axle direct, the other chain engaging with a sprocket on a counter shaft. The axle and counter shaft were connected together by spur gearing, by means of which a great reduction of speed, and a corresponding increase of power, was secured. The engine shaft sprockets were driven by clutches.

Chains are nearly analogous to belts, which were apparently considered less reliable, although their flexibility, light weight and silent running must early have attracted inventors. Such seems to have been the case, for belts are shown almost as early as chains.

The simplest belt-changeable gear would seem to be one endless belt in combination with two cone pulleys. This is a favorite device, and numerous patents show it. To avoid the friction caused by the belts engaging the inclined surfaces of the pulleys, the latter are sometimes shown stepped like a series of superposed pulleys of different sizes.

A series of slack belts, with jockey pulleys, was early invented. So was the machine shop arrangement of several tight belts, and fast and loose pulleys. A slightly different arrangement is to use slack belts, and tighten them by separating their supporting shafts.

Spur gears seem to divide themselves easily into two classes: Shifting and clutched gears. The shifting gears are keyed on a sleeve, secured to the shaft by a feather, and provided with means for shifting the sleeve and with it the gear. The gears were either carried by separate sleeves, or were so grouped upon a single sleeve, so as to engage with but a single gear on the opposite shaft. But a single lever is then required, while if independent sleeves are used an equal number of levers are necessary.

The shifting levers were usually pivoted to a ring, journaled in bearings on the sleeve, but shifting by means of a central rod, connected to the sleeve by a finger passing through a slot in the shaft. A lever having a forked end, which engages with

the two sides of one of the gears, is shown in an American patent.

Spur gears may also be arranged in constantly engaging pairs, in which case it is necessary to provide means for disengaging them, as desired. These means may consist of jaw clutches, which was an early expedient, or a sliding key, or friction clutches, the latter not introduced until recently.

One form of the spur gearing is the epicyclic train. Several are clearly shown in old patents. The epicyclic train has a fulcrum formed usually of a brake, which may be gradually applied and a fixed member thereby formed.

Either a plurality of trains may be used, the gears of the several trains being differently proportioned, or but one train of gearing, for either reducing or increasing the speed of the drivers in connection with means for disengaging the train and clamping or clutching the drivers to the driven shaft, to obtain the necessary two speeds. The several devices will be described in detail.

Bevel gears permit the easy application of speed changing mechanism to the ordinary transmission media. It suffices to add a second gear, and an additional pinion to the other gear. A shifting feather or key, or a jaw clutch, as with the spur gear, complete the device.

A pawl and ratchet device, with means for varying the travel of the pawl, has been very elaborately worked out by inventors working years ago. The usual arrangement is to connect the reciprocating members of the operating means to a ratchet clutch on the axle, and use simply an interposed link or equivalent device, to shorten the stroke of the clutch.

Means are illustrated in at least one patent whereby the direction of travel of the vehicle may be reversed, by changing the connection of the reciprocating member from the bottom to the top of the clutch.

Aside from hydraulic, pneumatic and electric transmissions, this ends the positive means for changing speed.

A great many friction devices are found.

These may be divided into two classes: Parts engaging on the periphery and parts engaging on the side, or combinations of pulleys or cones and disks.

Two pulleys almost in peripheral engagement, with a jockey pulley to communicate motion, is patented. Two cones with an embraced endless idler belt are also illustrated in a patent.

A modification of this form, showing two cones with an embraced idler jockey pulley, forms the subject of an early patent. In these three last forms, speed is varied by shifting the embraced medium in a path parallel to the driving and driven shafts.

A speed changing device employing a cone, with an engaging shifting pulley, is found in an old patent. The shifting pulley shaft may be arranged at right angles to the cone shaft, or to the engaging face of the cone.

A hemisphere with a peripherally engaging roller or pulley forms a simple and ingenious device for changing speed. The pulley is carried in arms, pivoted to a point contiguous to the centre of the sphere, and is thus kept in engagement with its curved face.

Disk speed-changing devices are found in great variety. Among the commonest is a disk engaging with the periphery of a pulley, the shaft of which is at right angles to that of the disk. The pulley is mounted on a sleeve, and may engage at any portion of the disk. Either shaft may be rotated. A reverse movement may be secured by moving the pulley past the centre of the disk.

A different device consists of two parallel disks with an embraced pulley. The latter may be moved out from the centre of the circumference of the disks to change speed. An improvement upon this arrangement consists in mounting the embraced pulley on gimbal joints, and oscillating it to obtain the desired variation of speed. The disks are, of course, formed to conform to the plane of movement of the pulley when at an angle to its supporting shaft. Power in this instance is transmitted from one disk to the other, the pulley being an idle one.

A single disk embraced by two oppositely arranged pulleys is illustrated in an old patent. Either the pulleys or the disk are moved to change the speed. So, also, speed may be changed by using two opposing disks, with a wedge-shaped disk pulley between the two, the three being carried by parallel shafts. In this case the disk and pulley engage on their sides. Speed is changed by advancing the pulley toward the centres of the disks, the latter separating for the purpose. A spring surrounding one shaft could keep the parts in constant engagement.

Returning to the original primitive speed-changing devices, about the crudest is illustrated in the British patent to Pierre Philippe Célestin Barrat, a Frenchman, who obtained his patent November 25, 1847, No. 11,977. The device illustrated in the patent consists of a series of endless chains, strung between pulleys of different sizes, and tightened as desired by suitable jockey pulleys. The jockeys were mounted in swinging frames, which were actuated by handles or levers.

An earlier English patent was that of William Henry James, of August 15, 1832, No. 6297. In this patent three chain wheels are keyed on the crank shaft of the engine. These communicate motion to three similar wheels on the driving shaft. The chain wheels being of different diameters, by clutching one of the wheels to its shaft different speeds may be given to the driving wheels. The latter are rotated by means of chain wheels on the second shaft and chains which pass over pulleys on the axle of the driving wheel. The clutches are applied by levers, any one of which may be actuated by the driver's foot.

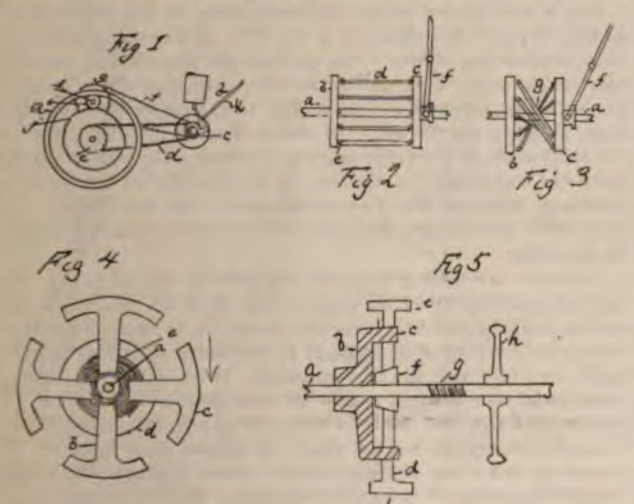
Two contemporaneous inventors, Joseph Gibbs and Augustus Applegath, obtained a British patent on September 29, 1832, which was numbered 6318. This invention consisted of two pinions on the crank shaft of different sizes, which gear with two spur wheels loose on the axle of the driving wheel. Either of these loose wheels can be clutched to the axle, so that two speeds can be given thereto. The axle is connected to the body of the carriage by means of springs, which springs are connected to the carriage by means of shackles at one end to allow of a certain amount of play.

An English patent was granted November 24, 1849, jointly to George Callaway and Robert Allée Purkis. In this patent, the number of which is 12,860, is described an arrangement of chain and spur gearing for allowing two speeds. The device is extremely ingenious and the principle employed might well be used at the present day. Briefly, the invention consists in directly connecting the engine to the driving wheels to obtain the high speed, and connecting the engine to the drivers through the agency of a countershaft and reducing gear to obtain the slow speed The device disclosed in the patent consists of two endless chains both connected to the engine shaft by spur gears and clutches. One chain engages with a spur gear connected to the driving shaft, while the other connects with and turns the countershaft. The two latter shafts are connected together by means of ordinary spur gearing, so proportioned, however, as to secure a great reduction of speed with a corresponding increase of power. As shown in the drawings accompanying the specification the device is so constructed as to secure a retrograde movement of the carriage upon the low speed gear being employed. This would have to be rectified by reversing the engine. If a plain gear on the countershaft engaging with an internal gear on the driving shaft, or some such equivalent, were employed, it would not be necessary to reverse the engine to secure a forward movement of the carriage at both of the two speeds.

This arrangement is illustrated in Fig. 1, of the accompanying drawing. In the illustration a represents one of the driving wheels, the other not being shown, as it might tend to confuse; b is the engine, shown as connected to the crank shaft c, and carrying with it two chain sprocket wheels connected thereto by means of a clutch. The endless chain d connects the crank shaft to the driving shaft by means of the sprocket

wheel e. This constitutes the high speed gear. The second chain f drives the counter shaft i by means of the sprocket g. The counter shaft drives the main shaft by means of the spur pinion h, and the large gear j. This constitutes the slow speed gear. A lever, shown conventionally at k, is used to clutch in either chain. It will be seen that a great reduction of speed is secured by the second gear, although it would be in a reverse direction. This would necessitate reversing the engine to secure the same direction of movement of the carriage when the speeds are changed. This, practically, exhausts the data upon which the evolution of chain gearing may be traced. The history of belt transmission is very similar. The series of endless slack belt with a jockey pulley for tightening one of them is well illustrated in the English patent of John Hippisley, of May 19, 1853, numbered 1,240. In this patent the conventional slack belt passing loosely over pulleys of different sizes with a movable jockey pulley is illustrated. The jockey pulley is mounted in bearings carried in forks upon one end of a hand lever.

About the earliest illustration of the tight belt passing over fast and loose pulleys is found in the joint English patent to Thomas Clarke and Thomas Motley, of March 14, 1849, No. 12,514. In this patent the common machine shop expedient of a fast and loose pulley upon one shaft, a wide fast pulley




upon the other and a tightly stretched belt between the two shafts, is described. An ordinary belt shifter is used to move the belt from the fast pulley to the loose pulley or vice versa.

An important variety of belt transmission is that which employs a single belt in connection with pulleys, so constructed as to be capable of increasing or decreasing diameter. Theoretically, this leaves nothing to be desired. Any speed from the lowest one wanted up to the highest could be secured with a desired degree of nicety without any shock to the moving parts. There is no early patent showing an expansible pulley applied to the driving gear of a motor vehicle. It is necessary, therefore, to look outside of the strictly technical class and see what has been done.

About the earliest, and, at the same time, the simplest structure, is disclosed in the American patent granted R. Eickemeyer, August 19, 1856, No. 15,559. This device relates to the pulley exclusively. It is formed of two disks, one keyed to the shaft, the other loose thereon and freer to twist and slide. The two disks are connected at several points upon their peripheries by metal rods or links secured to the disks by flexible joints. These rods form the working tread of the pulley. If the two disks be separated as far as the rods allow, the latter will be parallel to the driving shaft. If the disks be brought closer together the rods will necessarily twist, changing the outline of the device from a cylinder to the semblance of an hour glass. Any size of tread can therefore be secured, from a minimum of but a little larger than the supporting shaft, to a maximum as great as the disks themselves.

This device is illustrated in Figs. 2 and 3, which show the pulley in the expanded and retracted positions respectively. In both views a is the driving shaft, b the disk firmly keyed thereto, and c the disk loosely mounted thereon and free to twist and slide as occasion demands; d is a series of parallel rods flexibly connected at e with the peripheries of the disks; f is a lever engaging with a groove formed in the hub of the movable disk c. As shown in Fig. 2, the disks are separated as far as possible, sustaining the rods d in a position parallel to the shaft a. The belt will run upon the drum formed by the rods. As shown in Fig. 3 the disks are brought as close together as possible, twisting them relatively and forming a contour of pronounced hour-glass section. The groove g, formed between the disks, serves for a path for the bight of the belt.

Another American patent was granted to T. S. Savey, numbered 78,763, and dated June 9, 1868. In this patent the periphery, or rim of the pulley, is cut into sections each of equal length. Four are shown in the drawing. Each section is connected to and supported by a spoke, the latter sliding in a box in the hub and capable of being moved out and away from the supporting shaft. In order to draw out or push back the spokes and the attached rim section, a device identical with the scroll form of lathe chuck is used. This consists of a disk journaled upon and turning with the supporting shaft, and having a continuous spiral thread cut therein, running from a point adjacent to the supporting shaft out to the periphery of the disk. The spokes engage with this thread. For the purpose of locking them thereto they are provided with engaging teeth. If the hub and the disk turn at the same rate of speed the spokes and the rim sections will be irremovably locked as regards to their distance from the centre of the shaft. If, however, the disks turn at a different rate of speed, either by being retarded by a brake or accelerated by an outside source of power, the spokes will be advanced or retracted within the bearings in the hub, and the diameter, and consequently the circumference of the pulley, will be enlarged or reduced.

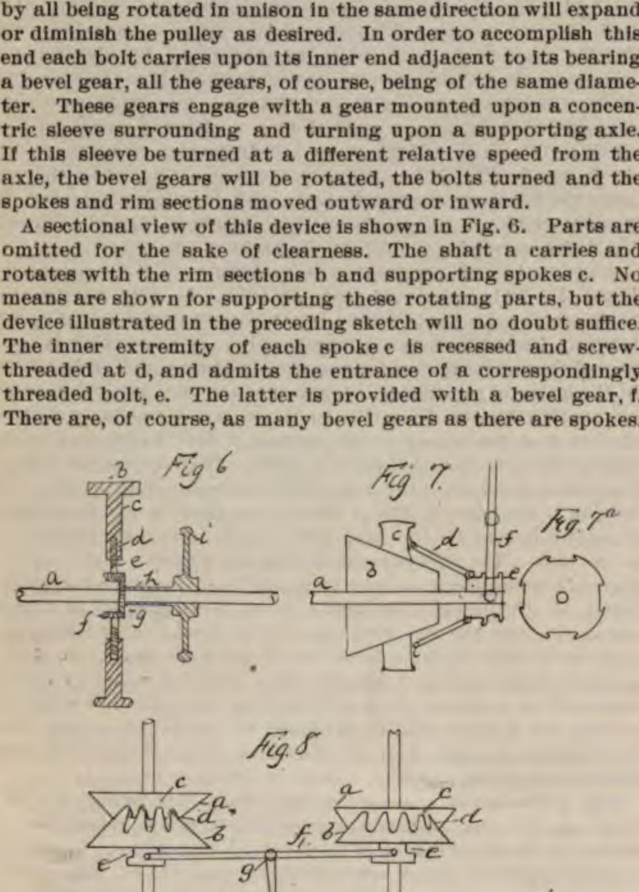
Fig. 4 illustrates, conventionally, how this pulley is constructed. The shaft a carries keyed thereto a hub, which is not shown in the drawing as it might tend to confuse. The hub carries recesses in which are mounted the spokes b. The latter are free to move in or out in relation to the centre shaft a. They each carry upon their upper extremity the peripheral section c. The four spokes are simultaneously moved away from or toward the shaft by means of the screw thread d, formed upon the face of the disk e. The threads engage with teeth, cut within the back of each spoke.

A quite similar device is shown in the American patent of W. Onions and I. Bagnall, No. 103,789, of April 18, 1871. The device is identical with the preceding, except as to the means for moving the spokes and rim sections. This means consists of a wedged block in the shape of a truncated cone surrounding the supporting shaft and engaging at its periphery with the inner ends of the spokes. A screw is used to move the block toward or away from the hub, and by the spokes engaging with the inclined face of the block, they may be moved and the diameter of the pulley changed.

This device is shown in Fig. 5, which illustrates the pulley and shaft in section. The shaft a carries keyed thereto the hub b, the latter having ears c formed thereon, which surround and support the spokes d, carrying the rim sections e. So much of the device is identical with that just described. The inner extremities are beveled at i, as shown, and engage with the periphery of the cone block f. A suitable rod with a screw thread g, engaging within a nut (not shown), will serve to move the cone block f either toward or away from the hub b. A hand wheel, h, may be used to accomplish this purpose. This arrangement possesses the advantage of having a non-rotatable adjusting device, a feature that the two preceding lack.

A third means of moving out the spokes and rim sections is shown in the patent to E. S. Barton, No. 113,723, of April 18, 1871. In this case the inner ends of the spokes are shown as provided with cylindrical holes screw-threaded internally. A bolt with engaging threads forms a continuation of each spoke. The bolts are mounted in bearings upon the hub, and by all being rotated in unison in the same direction will expand or diminish the pulley as desired. In order to accomplish this end each bolt carries upon its inner end adjacent to its bearing a bevel gear, all the gears, of course, being of the same diameter. These gears engage with a gear mounted upon a concentric sleeve surrounding and turning upon a supporting axle. If this sleeve be turned at a different relative speed from the axle, the bevel gears will be rotated, the bolts turned and the spokes and rim sections moved outward or inward.

A sectional view of this device is shown in Fig. 6. Parts are omitted for the sake of clearness. The shaft a carries and rotates with the rim sections b and supporting spokes c. No means are shown for supporting these rotating parts, but the device illustrated in the preceding sketch will no doubt suffice. The inner extremity of each spoke c is recessed and screw-threaded at d, and admits the entrance of a correspondingly threaded bolt, e. The latter is provided with a bevel gear, f. There are, of course, as many bevel gears as there are spokes.




The gears engage with a master gear g, carried upon a sleeve h, concentric to the shaft a. A hand-wheel, i, is used for imparting motion to the sleeves and gears. From the above description the operation must be obvious.

A rather different device is illustrated in the patent of F. M. Shaklee and S. B. Neptune, No. 178,029, of May 30, 1876. This device consists of a pulley formed of a number of rim sections. These sections are carried in dove tailed grooves upon the periphery of a cone, keyed to and turning with the driving shaft. It will be seen that if the rim sections be moved from the small end of the cone to the large end, the diameter of the pulley will be increased actually as much as the larger diameter exceeds the smaller. The rim sections are simultaneously moved by being pivoted to short links, which are in turn pivoted to a hub or sleeve, which latter is moved by a suitable lever.

Fig. 7 illustrates a section of this device. The hub b is keyed to the shaft a. This hub is cone-shaped, as shown, and has formed upon its outer surface a series of grooves, shown in section in Fig. 7a. These grooves support and retain in place the movable members c, carrying the tread portions for engagement with the belt. A series of links, d, as many as there are sections, connects there latter to the movable hub e. A lever, f, serves to move it toward or away from the fixture b, and thus vary the diameter of the pulley.

The preceding five devices all relate to single pulleys. In a motor vehicle it is necessary to provide means for taking up the slack of the belt as the diameter of the pulley is increased, or other means should be provided to avoid the stretching, which would be required upon the increase of the pulley's diameter. Such an end is easily accomplished by providing two expansible pulleys with a connecting belt and so arranged that one pulley can be increased in diameter as the other decreases. Such a device is illustrated in the patent of W. A. Wales, No. 178,746, of July 11, 1878. This patent is also interesting as illustrating a simple and ingenious pulley element. The two opposed pulleys are identical. Each is composed of two cone-shaped elements, the smaller ends opposing. Each element is cut away by a series of notches, leaving fingers and separating intervals of equal width. The two parts intermesh, the fingers of one element entering the separating spaces of the other. This forms a pulley with a central peripheral groove, which may be widened and deepened by the separating of the two parts. The separating is accomplished by means of a lever engaging with a groove in the hub of the movable element. In order to move the elements of the two pulleys simultaneously-but in opposite directions, to provide for the necessary enlarge, ment of one pulley and the reduction of the other, a single lever is employed pivoted to a fixed point half-way between the two shafts, and engaging with the two movable elements respectively.

Fig. 8 may give a better understanding of the construction of this device. It represents a top view of the two pulleys and their supporting shafts. The pulleys are identical in construction, each being formed of the two opposing disks a and b, cone-shaped, as shown. Each disk is cut away at c, at intervals, forming the fingers d, of nearly equal width. Each movable section, b, is provided with a grooved hub, which engages with the extremity of the lever f, pivoted in an intermediate position between the two shafts at g. By this device, when one pulley is enlarged, the other will be correspondingly reduced in diameter.

A device wherein gears are engaged by one of them being moved laterally upon its supporting shaft to intermesh with an opposing gear, not laterally movable, is early illustrated. To secure two rates of speed it is necessary that four gears be used, two of which shall be movable. It is, of course, desirable that only one pair of gears be intermeshed at a time. To accomplish this end the two movable gears are mounted upon a sleeve connected to the shaft by means of a feather. The movable gears are arranged with either a greater or a lesser separating interval than their opposing gears. By this means only one pair of gears can possibly be intermeshed at any one time. This arrangement, although very ingenious, seems to have been thought of at the beginning. Where two speeds are secured by shifting the gears, this arrangement is always present.

It is well illustrated in the American patent of E. C. Jones, No. 17,907, of August 11, 1857. For fear that the above printed description might not be understood Fig. 9 gives a view of Mr. Jones' device. In this device a is the engine shaft, carrying a small gear, b, and a large gear, c, geared thereon; d is the counter shaft, carrying the gears e and f, which may be made to engage with the gears b and c, respectively. The gears e and f may be keyed to a sleeve, which will rotate the counter-shaft by an interposed feather, or they may be directly keyed to the shaft, and the latter arranged to slide in its bearings. A shifting lever would engage with either the sleeve or the shaft, which ever would be required.

The same device, with a modified form of shifting device, is shown in Fig. 10. In this view the letter a represents the engine shaft, b and c the large and small gears, respectively, d the counter shaft, e and f small and large gears, respectively, keyed to the sleeve g. The novelty of the device consists in the shifting medium. The latter is a lever having a fork, h, embracing the two sides of the larger movable gear, f. The above described device is illustrated in the American patent, No. 217,-941, July 29, 1879, S. S. Hanks, patentee.

Instead of intermeshing the gears by shifting them laterally upon their shafts the same end may be accomplished by moving the gears away from engagement by separating their supporting shafts. Such a device is very ingeniously worked out in the arrangement illustrated in Fig. 11, which is taken from the drawings accompanying United States Letters Patent No. 181,220, granted to S. B. Stone, August 15, 1876. In the drawing, a illustrates, in section, the outer portion of one of the driving wheels, the inner face of which carries the external gear b and the internal gear c. They are shown as being formed upon an integral flange. The engine shaft d carries a pinion e upon its outward extremity. This pinion is of a diameter equal to the thickness of the aforedescribed flange. The gear changing device consists of a movable frame or carriage, f, mounted in bearings in the frame of the vehicle. Upon this carriage are journaled the shafts g and h, which carry the equal-sized pinions i j and k l, respectively. As shown in the sketch the pinions k l engage with and connect the pinion e, and the external gear d producing a low speed. At the same time the pinions i and j will be disengaged and will remain so. If the carriage f be shifted the pinions k and l will be disengaged, and the opposite pinions i and j will engage with and connect the gear e with the internal gear c, producing a higher rate of speed.

Fig 9

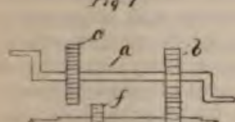


Fig 10

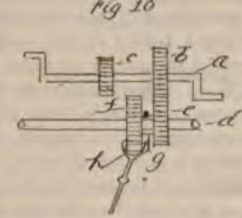


Fig 11

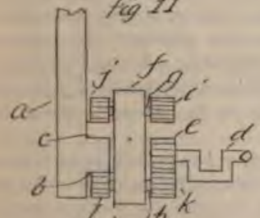


Fig 12

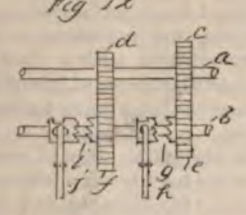
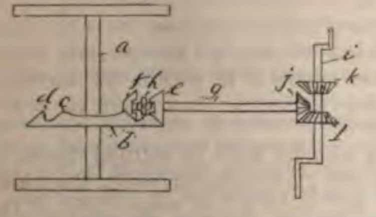


Fig 13

Fig 14



The English patent of Barrat, previously mentioned, is about the earliest illustration of the conventional form of dog clutch combined with several series of intermeshing gears. An earlier patent is that of Joseph R ynolds, of January 9, 1816, No. 3,973, which illustrates a dog clutch having a notched movable member engaging with teeth formed upon the faces of the gear wheels. In these two latter patents but a single movable clutch member is used to secure the two speeds, a movable member being arranged between the two gears. As late as 1879 the same end is accomplished by the cumbersome and complicated expedient of a separate clutch and a separate lever for each speed change. This is shown in the patent to H. H. Brindenthald, of March 4, 1879, illustrated in Fig. 12. The two shafts a and b carry the gears c d and e f, respectively. The gears c d are permanently keyed to their supporting shafts. The gears e f, which permanently intermesh with the other gears, are loosely mounted upon the shaft b. A jaw clutch, g, operated by a lever, h, connects the gear e to its supporting shaft. A clutch, i, with an operating lever, j, performs the same office in regard to the gear f.

Instead of the jaw clutches just described, cone or friction clutches have been substituted. A good illustration of this is found in the British patent to W. W. Urquhart and J. Lindsay, No. 1994, of March 22, 1877, which shows a friction clutch substituted for the jaw or ratchet clutch just described.

Bevel gears form a ready means of changing speed. They are also easily combined with the usual transmission media. The two following illustrate simple and ingenious devices. They are both American patents. The first is that of T. Blanchard, of December 28, 1825. The device is illustrated in Fig. 13, which shows the top view of the gear, with one of the driving wheels in section; a is the supporting axle and b the driving wheel; c, d and e are bevel gears of different diameters, concentrically arranged upon the inner face of the gear b; f, g and h are bevel pinions, engaging with the aforesaid gears; i is a longitudinal shaft carrying the bevel pinions and also a driving spur pinion, j, connected to the propelling engine. Any of the pinions f, g and h may be connected to the supporting shaft i, by means of a sliding key k. The latter is operated by a rod, l, passing through a hole formed in the centre of the shaft i; m is an operating lever for moving the rod l, and with it the key k.

The second device is illustrated in F. L. Fairchild's patent, No. 230,762, of August 2, 1880. This is illustrated in Fig. 14. The driving shaft, a, carries a gear b, having formed thereon two series of bevel gears, c and d. The latter connect with the pinions e and f. A longitudinal shaft g supports the two and drives either through the agency of the clutch, h. The longitudinal shaft g is driven in either direction from the engine shaft i by means of the three bevel gears j, k and l, arranged as shown.

*(To be Continued.)*

## A PERMANENT AUTOMOBILE EXHIBITION IN BERLIN.

A permanent automobile exhibition has been instituted in Berlin, in a large and centrally located hall near the Friedrichstrasse Railroad Station, which it is hoped will bring manufacturers and purchasers into closer contact and stimulate the sale of automobiles. The exhibition will include all kinds of motor vehicle for both pleasure and business, and also accessories, tools, models, etc. There will be over 12,000 square feet of floor space, and the fees will be moderate. The enterprise is backed by leading men of the financial and industrial world, and will be under the management of Gustav Freund, who managed the technical part of the International Motor-Car Exhibition in Berlin last year. Inquiries should be addressed to him at Berlin, N. W., Dorotheen-Strasse 6, care Automobil-Ausstellung.

# ...COMMUNICATIONS...

## UNITED ACTION AGAINST THE OPPRESSION OF THE LEAD CAB-SELDEN TRUST.

PHILADELPHIA, PA., June 18.

*Editor* HORSELESS AGE:

The recent publication by *The Motor Age* of the Selden Patent No. 549,160 complete, together with the criticisms relative to it, is timely, for while this matter has been brewing some time, and the significance of this patent was pointed out in THE HORSELESS AGE of Dec., 1896, it was hardly credited, and few knew of the intention of the Columbia Vehicle Co. to attempt to control the field of gasoline automobiles under this patent. The suggestion that the defence of any suit under this patent should be carried on in the joint interests of those who would be affected by an adverse decision is sound common sense, and the only safe manner of dealing with the question, because the time to nip such a colossal and far-fetched attempt is at its incipiency and before any unwarranted decision of the courts, based upon a meagre showing of the ample defence available, is secured. As one who has followed the automobile art closely and been identified intimately in the patent situation upon the same for a great many years past, I am prepared to assert that the aspiration of the Columbia and Electric Vehicle Company to the monopoly of the gasoline vehicle by virtue of the Selden patent is absurd and wholly untenable.

My long experience in patent litigation, and especially my attention to motor vehicles, leads me to say that the Selden patent upon its face is much more limited than it appears to be. There is not a single claim in it which could be sustained for a legal construction which would give the owners of the patent a monopoly. If the claims are construed in any manner generically sufficient to control the industry, they will be anticipated by many patents not hinted at in its specification or file wrapper. That Selden was not the first to propose the use of a gasoline engine as the motor for a wagon is acknowledged in the patent itself and the idea that there is some inherent novelty in the combination of such a specific motor with the rest of the elements is too preposterous to merit serious consideration.

It is a fact that automobiles have been described prior to the date (1879) of the filing of the Selden patent, showing the reciprocating motor and "having a rotating shaft connected with and arranged to run faster than the propelling wheels, and intermediate clutch or disconnecting device" for connecting or disconnecting the engine shaft with the driven wheel. They show further, the running gear in which the steering is performed by a rack and gear control of the fifth wheel structure in which the wheels are journaled. The arrangement of the engine, the vessel to contain the fluid for generating its motive force, the rapidly driven engine shaft, the slower driven wheels and axle, the speed reducing gearing between the motor shaft and axle, and the clutch or disconnecting device to connect or disconnect the engine shaft with the axle to allow it to rotate without propelling, combined with and placed on the truck and the truck swiveled on the vehicle body by a large fifth wheel, which is provided with rack and gear-steering means controllable by hand, are old in the prior art. This being so, where does the Selden invention come in, either generically or specifically? The incorporation of the liquid fuel receptacle into the claims will not add to its validity or strength, but is most damaging to the preposterous contentions of the owners of the patent as it is positive evidence of the restricted character of the claims. The same is true of the only mode of reversing the vehicle shown, which requires the motor, wheels and axle to be bodily turned around.

These facts will cast a little light upon the language found in the first part of claim 1, the claim particularly relied upon for the monopoly, to wit: "Provided with suitable running gear, including a propelling wheel and steering mechanism." Analyzed, it simply means a running gear connected to the body by the fifth wheel so that it can be revolved about its ring bolt, and having one (or two if you wish) propelling wheel, the engine and gasoline tank moving with the axle and fifth wheel. That is as broad as any reasonable construction can put upon it, and I do not admit that it is even clothed with any novelty when so limited, for the reasons stated above as to the prior art. There are numerous patents anterior to the available date of Selden, which would so narrow and restrict the possible scope of his patent to save it from invalidity that it would be difficult to find its applicability to the general types of gasoline vehicles which are in use. There are a number of defences to the Selden patent. As some of your readers may think I am perhaps too sanguine, I would only ask them to bear in mind that as my own patents relating to motor vehicles are upward of two hundred, I have during the last 20 years had much to give this matter serious thought. I am not mistaken in my views thus briefly expressed above.

As the attorneys of the Columbia and Electric Vehicle Co. are the attorneys of the General Electric Co., and stand with the best legal talent in the country, too much caution cannot be exercised to guard against allowing them to secure for their clients an unreasonable decision for want of proper defence.

Frequently the course pursued is to bring suit against a manufacturer who cannot or who is not interested sufficiently to make a strong defence. The court, "educated" (?) by the specious and ingenious arguments of counsel for the complainant, is unintentionally led into giving a decision wholly inconsistent with the real facts as to the art, which places in the hands of the complainant a strong weapon to use thereafter in applying for preliminary injunctions against the stronger manufacturers with a view to throttling all competition. If the manufacturers of gasoline vehicles are wise they will array themselves as a unit against any such attempt upon their rights.

For the satisfaction of your readers I may say that preparations are now being made with a view of bringing several suits against the Columbia and Electric Vehicle Co. and its licensees for wholesale infringement, and any attempt on their part to monopolize the automobile art may prove a "boomerang," which they will not easily forget.

R. M. HUNTER.

## AN ABLE EXPONENT OF THE TWO-CYCLE ENGINE.—AMATEUR GAS ENGINE BUILDERS.

OXFORD, MICH., June 9.

*Editor* HORSELESS AGE:

My reply to Mr. Howard's article, in your issue of May 23, will principally consist in analyzing in a general way the various actions that take place and that should take place in the two types of engines.

Mr. Howard's theory and practice in regard to lead in opening the exhaust of a four-cycle engine is correct, and by doing so he keeps his exhaust open about ⅝ instead of ½ of a revolution, as I stated in my article in April 25, in which I was not speaking within close fractions, but was showing how and why a very reasonable lead kept the exhaust of a two-cycle engine open for more than ¼ of a revolution, in reply to the misstatement by Mr. Towle, in your issue of March 21, that the intake and the exhaust of a two-cycle engine had to take place within ¼ of a revolution, unless an excessive lead was

given. But we will proceed. That we may be concise in designating motions we will suppose the engines to be vertical, the piston is taking in an explosive charge on the down stroke of a four-cycle engine. The piston in passing down draws in (unless throttled) its cubic capacity (that is, its area multiplied by its stroke) of explosive charge.

When the piston begins its downward stroke the combustion chamber (as we will call that part of the upper end of the cylinder in which the piston does not travel) is full of carbonic acid gas and nitrogen, the burnt gas of the previous explosion, and the incoming charge is mixed with it, so that at the end of the stroke we have about three parts explosive charge and one part burnt air, and upon compression and ignition we get less than three-quarters of the pressure for our power impulse than we would have gotten had the charge been pure.

The six-cycle engine, in which an explosion occurs every third revolution, the extra revolution being employed to suck in pure air and expel it again in order to get rid of the carbonic acid gas left in the combustion chamber after the exhaust of a four-cycle engine, gives good results and has many intelligent advocates. When the two-cycle engine piston descends, the crank chamber being air-tight and full of air, or explosive mixture, the piston compresses the mixture within the crank chamber, so that when an opening is made, and it is allowed to escape into the cylinder at the end of the down stroke, when atmospheric pressure is restored in the crank chamber, exactly the quantity of air or explosive mixture has passed into the cylinder that would have been sucked in by a four-cycle engine by its intake stroke. Now, air is like all other matter, it has inertia; that is, it requires force either to set it in motion or to stop it after it is in motion. The downward stroke of the piston, we will suppose, was caused by an explosive impulse; then, when nearly to the end of the stroke, the exhaust port opens wide and quick, the pressure within the cylinder is from 30 to 40 pounds to the square inch, and the exit of the exhaust is consequently very rapid until atmospheric pressure is attained within the cylinder, at which time the exhaust pipe is full of air in very rapid motion. If care is taken in designing and constructing the exhaust pipe the inertia of this rapidly moving column of air will produce a very considerable vacuum after the air compressed in the crank chamber has all passed into the cylinder, and more air will be sucked in through the still open inlet port, and at normal speed the poppet valve admitting the air into the crank chamber, opens to admit air in response to this vacuum before the piston fairly commences its up stroke and long before the inlet port into the clyinder is closed. Thus at least one-third more air can be passed into the cylinder than the cubic capacity of the piston stroke, and there can be a much cleaner sweep-out of the burnt air than is possible by the four-stroke, and equal to the six-stroke method of doing it, and all in one revolution, thus avoiding the friction and resistance of the extra revolution or revolutions of the four or six-cycle engines, thus lessening the difference between the actual and indicated h. p., and the same-sized engine will give three times the power of a six-cycle and more than double the power of a four-cycle engine.

Now, with all these possibilities at hand, why is it that such poor results are obtained as Mr. Howard describes? As has been pointed out by the four-cycle advocates, the four-cycle problem is simple and easily worked out, while the two-cycle presents some very difficult problems; difficult because the knowledge necessary for the solution is not common, and several problems come in which belong each to separate sciences, and probably no one scientist in the world could solve all of them without research in line outside of his own specialties. One problem is to project a column of gaseous fluid into a vessel containing another gaseous fluid, in such a way that the incoming gas will completely expel the contained gas without mixing or escaping with it to any appreciable extent. If the vessel were a long pipe of small diameter, and the gas could be projected in a solid mass into one end, while the exit was made at the other free end, it would be easy, but with a gas engine you could not take off the cylinder head and let the gas in in a solid column; and a valve, although it might be the full size of the cylinder head or be a multitude of small valves covering the clyinder head, would divert the gas so that it would not enter in a solid column. The best method to date is to admit the air up one side of the cylinder, while the exit is made at the bottom of the other side of the cylinder, and a good share of the failure of two-cycle engines is just at this point. To get perfect results the inlet ports and deflecting shield on the piston head must be of such size and shape and proportion to each other, and to the cylinder, that not only will they project the incoming air in a solid column, but that column must be of such size and shape that by the time it reaches the cylinder head it has spread out just sufficiently to cover nearly one-half of it; the incoming charge is then deflected back toward the exhaust ports and will continue spreading so that when it reaches the piston again it will be as much wider than one-half of the cylinder as the incoming column of air is narrower, and practically a clean sweep will be made. The size, shape, etc., of both ports and deflecting shield, to perfectly accomplish this result, and the several other problems of equal importance and difficulty in two-cycle engine construction can all be figured out by the amateur in from 15 minutes to 24 hours, according to how little he knows; but the scientist will take days and perhaps weeks in collecting data and in preliminary experiment, before commencing to build, and then perhaps rebuild several times before he will allow the machine to be placed on the market. When this problem is mastered, we find that the incoming charge is liable to be ignited by the hot gases of the exhaust, which, of course, are not yet expelled from the cylinder, but merely cooled down by expansion. The higher the speed of the engine the more certain is this accident to occur, so if we stop here our engine will not be as practical after all, as the ordinary make of two-cycle engines, in which no attempt is made to make a clear sweep, but only a portion of the exhaust is expelled and a small charge of explosive mixture substituted. The higher the speed, the less exhaust escapes and the less explosive mixture there is admitted, and before a speed is attained that makes ignition of the incoming charge likely, the mixture in the clyinder is so loaded with carbonic acid gas that it will not ignite and it misses explosions. The purer the explosive mixture the more powerful are the explosive impulses, so that much that is urged against the two-cycle engine for vehicle propulsion is true if we do not get beyond this construction. Now, as I stated in my former letter, the way we master this last-mentioned difficulty is by admitting pure air first, then the explosive charge. Our exhaust and admission ports are timed and proportioned, so that when running at 700 revolutions per minute, by the time the piston begins to uncover the inlet ports the exhaust has reduced the pressure in the clyinder to crank chamber pressure. We time it thus so that there will be no break in the motion of the exhaust and thus mar our siphon action. About one-third of the piston cubic capacity of pure air is then admitted, then the other two-thirds as explosive mixture, and another third of explosive mixture is siphoned in, as explained in the beginning of this article. By this way of operating a two-cycle engine no part of the explosive charge can escape with the exhaust, as there is a thick stratum of pure air between, and what mixing of incoming and outgoing columns there is will all be between exhaust and pure air, not explosive mixture. There will be no premature ignition, no matter how high your speed, for a stratum of pure cold air stands guard between; and cleaner explosive charges and consequently more efficient power impulses than the four-cycle are the result. Accurate calculations must be made for all the openings, so that exact proportions are maintained. This can best be done by assuming a definite speed, and making that speed the base of all mathematical calculations, which speed will then be the speed of greatest efficiency; but a wide range of speed both ways from that will be practicable. We make

700 the speed of greatest efficiency in our small engines, and get fine results at from 300 to 1,000; their pull even at 200 is remarkable.

We are opposed to the use of poppet valves on general principles, but they seem to be the only thing that will do the business for admitting the air into the crank chamber, as it must open promptly and only in response to vacuum, in order to get the benefit of the siphon action; so we make our inlet a poppet valve of very light construction, large area, small lift and of aluminum, and hold it to its seat by a light piano wire spring, so that it responds instantly to the slightest change of pressure.

The next question is, What constitutes a smooth-running engine?

Throttling is the method in common use to vary the speed of the vehicle gas engine, because, when running light, the reaction of the power impulses do not jar like a full charge. But what about it when you have to have full power? Of course, the vehicle is then under motion and the effect may not be as disagreeable as the same jar would be in a vehicle that was standing still, but it is disagreeable and destructive to the vehicle and should be avoided; better make lighter impulses and more of them and avoid the jar.

The two-cycle engine does this: The cylinder need be only one-half the size of the four-cycle, and consequently requires only one-half the size and weight of balance wheel and one-half the effort when starting up by hand; the impulses need be only one half as strong, it can be run at as high a speed as it is practical to run reciprocating parts, and it will give a full efficient power impulse every revolution.

If we use two cylinders, these advantages are again multiplied, and we get also a perfect balance of reciprocating parts and at 1,000 revolutions, 2,000 power impulses per minute, or 33 per second: at half that speed the impulses are so close together that they are almost imperceptible. In cases where cheapness is imperative a single cylinder will have to answer; but a high-grade automobile should have a motor with at least two cylinders of the two-cycle type or four cylinders of the four-cycle type; while the highest ideal for a motor is four two-cycle cylinders.

For ignition I prefer a magneto generator run at the full speed of the engine. Our sparker is in contact about 1-12th of a revolution; it is a good sparker and three volts will give a sure ignition when running two or three hundred a minute, but at higher speeds the time of contact is so small that the spark coil will not charge without a higher pressure, and at 1,000 revolutions the time of contact is so infinitely small that a 110-volt current turned on from the line will not injure the spark coil or sparking points; but, of course, we get an enormous spark and an absolutely sure light. Now, with the magneto varying in speed with the engine, we get exactly the right conditions; the pressure increases as the time of contact diminishes, and we do not burn off the points of contact when running slow, nor miss ignition when running fast, as we would if limited to a constant voltage; and the possibility of failure to ignite is practically eliminated.

I notice that almost all of your correspondents express themselves as believing steam to be the motive power for vehicles.

From 10 to 15 years ago the same battle was fought; the steam engine, with its automatically-regulated gasoline burner and automatic water regulator, disputed with the gas engine for supremacy in the propulsion of small pleasure yachts. Electricity, with its storage battery, took a hand; steam at first took the lead, while the swell affair was the electric motor.

I doubt if you could find to-day one automatically regulated steam engine on a yacht, or one electric motor, if you searched all our lakes and rivers. The last grand farewell effort of the electric motor was at the World's Fair at Chicago in 1893; but you would find thousands of gasoline engines, and at least three-quarters of them are two-cycle.

How could you expect a different result? The most scientifically designed and mechanically perfect steam engine that can be built to-day will consume more than three times the amount of gasoline to produce the same power that a very common ordinary hit-and-miss gas engine will.

A good gas engine is so much more convenient than steam, always ready to start on a moment's notice; steam never goes down and the maximum power is always immediately available on demand, and the weight and bulk is so very much less.

There are several manufacturers turning out stationary gas engines that are thoroughly reliable in their action, as reliable as an ordinary steam engine and giving very much less trouble; and vehicle gas engines can be made that will be the same. The curse of the vehicle industry now is the amateur gas-engine builder, and from an article by one of your correspondents not long ago it seems that the amateur steam-engine builder is also in it. But steam is different, as a very imperfect steam engine will run, while a slight error in the design or workmanship of a gas engine makes it unreliable and practically worthless. There are so many things about gas engines that to even an intelligent but inexperienced designer would seem trivial that are really of vital importance.

Yet this is the field into which many who could not be trusted to design a wheelbarrow rush with all assurance; they can decide the most intricate problems off-hand, and before the experienced and careful mechanical engineer can perfect a really reliable engine, fully adapted to the new conditions, they have a large company organized and a factory turning out engines, and the papers filled with advertisements and notices, "Old methods and old prices must go" (the first thing that this class of people do is to cut prices below what a really good article can possibly be made for), and they also have plenty of customers cursing gasoline engines in general, and that gas engine in particular, as the most unreliable, unsatisfactory and deceptive motive power ever invented. C. P. MALCOLM.

[The idea of augmenting the power of a gas engine by letting the inertia of the exhaust column draw in a surplusage of fresh mixture is not new. Atkinson and Crossley, in England, observed the phenomenon some time ago, and designed an engine to utilize it. The same thing has been alluded to lately in the columns of THE HORSELESS AGE, and it is evidently as applicable to four-cycle as to two-cycle engines, if the valves of the former be suitably located. The editor recalls the case of a 6 h. p. two-cycle engine, whose normal power was increased 25 per cent. by the use of a particular length of exhaust pipe, while either a shorter or a longer pipe, or no pipe at all, gave substantially identical results, i. e., the normal power only. We fancy that two reasons why so little is heard of this method of getting a maximum power from an engine are, that a muffler is usually considered indispensable, and that it is not always practicable to use the particular length of pipe required. Of course, on a vehicle the latter point could be provided for.

Mr. Malcolm writes us that the above interesting letter will be followed by another, describing the mechanism by which he obtained the results set forth.—ED.]

## A TEST CASE IN BALTIMORE.

BALTIMORE, MD., June 15.

*Editor* HORSELESS AGE:

On Sunday, the 10th inst., I was arrested for entering Druid Hill Park with my locomobile. At the hearing the case was dismissed, there being no fine for violating the Park Board's mandate. To-day a fine of $5 was placed upon such as break the order. Electric machines are not intercepted, but gasoline and steam are not admitted.

As the Park Board refuses to allow us (locomobile and gasoline motorists) any consideration we have decided to be arrested and fined, and after that to make a test case of the rule. There are eight steam and two gasoline wagons here and the owners are pledged to stand by each other and fight what to future generations will certainly look like an unprogressive order.

We are all heavy tax-payers and should be allowed as much freedom of the several parks as other people. As I said above, we are about to make void forever the absurd mandate of Baltimore's Park Board, and will therefore have to test the case in court. We will need all the data procurable of decisions in other cities (decisions where one power is allowed as full privileges as another) before we commence operations. Could you furnish these papers? Remember, electric wagons are tolerated—we are to find out if the Board can discriminate between powers.

E. J. FARBER, JR.

## THE LOCOMOBILE IN HILL CLIMBING.

NEW YORK, June 16.

*Editor* HORSELESS AGE:

We are advised by our agent, Mr. E. J. Halsey, 52 Sussex place, South Kensington, London, of an interesting occurrence in the 1,000-mile trip held last month. As you probably know, one of our "Locomobiles" completed the 1,000 miles in a very satisfactory manner. The steepest hill encountered on the tour was Bunny Hill, just outside of Nottingham. The performances of the motor vehicles on this incline were carefully recorded and classified. Forty-eight vehicles competed in this trial, and were classified in nine groups, as follows:

1. Very good. The "Locomobile" Company of America's steam carriage, two passengers.
2. Nicely. 6 h. p. Panhard.
3. Steadily. 5 h. p. Marshall.
4. Well. 21 vehicles.
5. Easily. 8 h. p. Lanchester.
6. Tacked up. 2 vehicles.
7. Shed passengers to ease or help push. 12 vehicles.
8. Stuck. 7 vehicles.
9. Shed passengers and stuck. 3½ h. p. Decauville.

THE "LOCOMOBILE" COMPANY OF AMERICA.
(J. A. KINGMAN.)

## A GOOD ROADS CONGRESS.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF PUBLIC ROAD INQUIRIES,

WASHINGTON, D. C., June 11.

*Editor* HORSELESS AGE:

The Office of Public Road Inquiries is in receipt of a call for an International Good Roads Congress to be held at Port Huron, Michigan, July 2, 3, 4 and 5, 1900. The call is signed by Chief Consul H. S. Earle, of the League of American Wheelmen for Michigan; Prof. Clinton B. Smith, Director of Experiment Stations and President of Farmers' Institutes; A. W. Campbell, Provincial Road Commissioner, Toronto, Can., and Andrew Pattullo, M. P. P., President Ontario Good Roads Association.

The objects of this meeting are to awaken and promote a more general interest in the improvement of the public roads, to discuss the various ways and means of securing the necessary funds for this purpose, as well as the best methods of constructing and maintaining them.

The citizens of Port Huron have raised the necessary funds to build a mile of macadamized road, under the supervision of E. G. Harrison, road expert, of this office. The construction of this road will be in operation during the convention, thus affording a natural object lesson, and Mr. Harrison will be on the ground as the work progresses in order to explain the details of technical road building to the delegates.

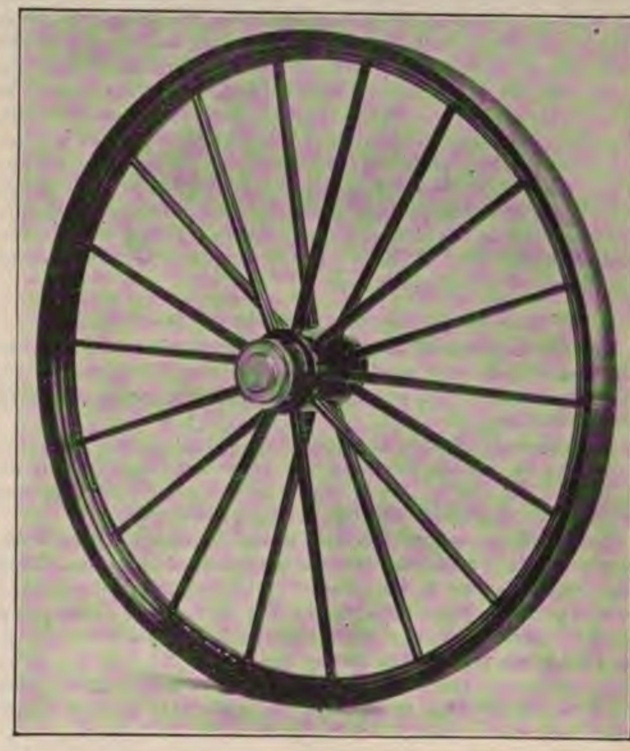
The State and local Road Improvement Associations and societies, the Boards of Trade, the Chambers of Commerce, the Patrons of Husbandry and Farmers' Institutes associations, Wheelmen's Leagues, and all other public bodies concerned in the road subject have been especially invited to send representatives, and the presence of all the friends of the movement is earnestly solicited by the Invitation Committee.

MARTIN DODGE, Director.

P. S.—It may be of interest to delegates to note that the Michigan and the Central Passenger Associations have offered their co-operation to the extent of furnishing one fare going and one-third fare returning; provided delegates secure a certificate from their home ticket agent and present the same to Henry E. Perry immediately upon arrival at Port Huron.

## THE MIDGLEY VEHICLE WHEEL.

The wheel shown in the accompanying cut has been designed specially to meet the requirements of combined driving and supporting of a dead load, it being endeavored to make the wheel as rigid as possible.



The rim is hollow and of crescent section, and the spokes are of oval tubing and tapered, with reinforcements at rim and hub. The hub is drawn from heavy sheet metal and can be formed to suit any style of bearing. It is made double to allow ample brazing surface for the spokes. The whole is assembled in a jig, brazed by immersion in a crucible and allowed to cool in the jig, which insures the trueness of the wheel. By this process the spelter, flowing over the inner surfaces, protects them from rust, and the enamel performs the same service for the outside.

As the wheel is wholly of metal and brazed, it is of light appearance as compared with wood wheels, and there is nothing about it to shrink and work loose, nor are there any threads to strip or unscrew. The wheel is the invention of Tomas Midgley, of Columbus, O.

## ...OUR... FOREIGN EXCHANGES

### TRIALS OF MOTOR VEHICLES FOR HEAVY TRAFFIC.

Under the auspices of the Liverpool Self-Propelled Traffic Association an important series of trials for motor vehicles for heavy traffic will take place in June, 1901.

These are intended to provide a means of making a preliminary test of types of heavy motor-wagons suitable for haulage operations in Lancashire prior to their being taken over by a Lancashire syndicate which is to be formed to conduct road transport between Liverpool and the manufacturing towns of Lancashire. Loads of general merchandise will be collected and delivered during the tests, thus giving practical demonstrations, and the trials will be from Liverpool to Manchester via Warrington, from Manchester to Liverpool via Bolton, from Liverpool to Blackburn via Chorley, from Blackburn to Liverpool via Preston, each journey to take place on one day in the first week of June. There will also be hill-climbing at Everton Brow and manœuvring at Prince's Dock. The vehicles will be tried in three classes, and the judges in making the awards will consider (a) cost, (b) control, (c) working, (d) construction, (e) special points with regard to vehicles propelled by steam, oil or electricity respectively. The competition will be of an international character, and the results should have an important bearing on the future of the industry. Below we give the general regulations applicable to the vehicles and the rules and conditions of the competitions.

GENERAL REGULATIONS APPLICABLE TO ALL VEHICLES.

(1) The vehicle shall be self-propelled and self-contained. It shall be propelled by mechanical power alone, but there shall be no restriction on the source of such power or the nature of the agents used.

(2) The vehicle shall be capable of going anywhere that a horse-drawn vehicle carrying the same load is ordinarily required to go, and of being placed in the same positions and withdrawn therefrom without external assistance.

The particular manœuvre most generally called for is to work into and out of a loading berth when cramped for room. This requirement arises in the case of embayments, or of confined spaces between other vehicles in a line receiving or discharging goods. Carters usually back into such positions obliquely, and bring the vehicle into line by turning the leading wheels at right-angles to the rear wheels and again backing, but it is open to competitors to perform the manœuvre as they think best.

(3) The vehicle shall be capable of working into and out of an embayment of one and a half times its own length.

(4) The vehicle shall be capable of starting from rest on and mounting a gradient of one in nine (sets).

(5) The capacity of any water tanks, whether the same be fitted for feed, cooling or other purposes, shall suffice for a run of 15 miles on the basis of the consumptions during the trial runs.

(6) Such portion of the platform of the vehicle as is designed to carry the load shall be level, and the height of the floor line, measured either when light or when laden, shall be not less than 3 feet 6 inches, and shall not exceed 4 feet 3 inches.

(7) The vehicle shall conform in all respects to the requirements of the Locomotives on Highways Act, 1896, and, in the case of its being oil-propelled, of the "Regulations as to Petroleum" issued by the Home Secretary, under Section 5 of this Act. In Class C, intended for vehicles for export to the colonies and abroad, there is no tare limit, but the other regulations must be adhered to.

(8) All working parts shall be properly encased.

(9) The boiler, tanks, oil-baths and connecting pipes shall be fitted with drain-plugs at their lowest points.

(10) The cross-section of any pipe connecting two tanks shall be not less than that of the pipe provided for filling the first tank of the two.

(11) Provision shall be made to lock the compensating gear.

VEHICLES ELIGIBLE FOR COMPETITION.

| Class | Load | Maximum Tare | Minimum Level-Platform Area | Minimum width of Driving Tires | Speed |
|---|---|---|---|---|---|
| A | 1½ tons. | 2 tons. | 45 sq. ft. | 3 in. | 8 m. pr. hr. |
| B | 5 " | 3 " | 75 " | 5 " | 5 " |
| C | 5 " (minimum) | No limit. | 95 " | 6 " | 5 " |

RULES AND CONDITIONS.

(1) The vehicle shall carry the weight of goods specified for its class, any excess weight in Class C being declared in advance by the competitor, throughout the continuance of the trials.

(2) Each competitor shall himself make all arrangements for the necessary staff and appliances to work his vehicle or vehicles. Accommodation for the vehicles, in Liverpool, Manchester and Blackburn, will be provided by the association. Vehicles intended for trial shall be registered as "arrived," at the Liverpool Depot, not later than noon on Friday, May 31, 1901.

The association will arrange the supplies of water at intermediate depots.

(3) The official observers will accompany each vehicle during the trial runs to take notes of behavior, fuel and water consumption, etc., and no repairs will be permitted without their knowledge and consent.

(4) Any vehicle withdrawn from competition during the trial, except under the written authority of the judges, shall be ineligible for a prize or for commendation.

(5) Twenty half-plate photographs of each vehicle shall be furnished by the competitor, not later than May 16, 1901.

These must be delivered in good order at the Liverpool Royal Institution, addressed to the Honorary Secretary, Liverpool Self-Propelled Traffic Association.

(6) Entries shall be made on printed forms (to be obtained from the honorary secretary), and shall be accompanied by an entry fee of ten guineas per vehicle.

Entries will be received under cover of a registered letter, by the honorary secretary, Liverpool Self-Propelled Traffic Association, the Royal Institution, Colquitt street, Liverpool, any time prior to 12 noon on the last day of April, 1901.

(7) A complete list of particulars, together with tracings or blue prints of the general arrangement and principal parts, shall be lodged with the honorary secretary not later than May 16, 1901, and further detailed drawings shall be submitted to the judges, in confidence, if required, while the trials are in progress or at their conclusion.

The description must be printed and 200 copies must be furnished. The particulars required are those enumerated in the section entitled "The Competing Vehicles" in the report on the 1899 trials.

(8) Each competitor shall arrange to have his vehicle or vehicles ready for inspection by the judges at 3 p. m. on the afternoon of Friday, May 31, 1901, in the Liverpool Depot, when the dimensions, capacities and weights will be taken by the observers.

(9) All vehicles shall be stored overnight at the depot or depots provided by the association.

(10) At the conclusion of the trials any vehicle, or motor, or part thereof, shall be opened up, in confidence, for inspection by the judges if required.

(11) Each vehicle will be allotted an official number, which

shall be displayed during the continuance of the trials. Competitors must provide two boards or plates, each one foot square, with their number painted in black on white, the figures to be not less than 8 inches deep, for attachment in the front and rear of their vehicle.

The judges reserve to themselves the right of absolutely disqualifying any competitor for any infraction of these rules.

While obeying in all respects the instructions of the judges and the conditions of the competition generally, it is to be fully understood and agreed by every competitor that no responsibility, legal or otherwise, is to attach either to the judges or the Liverpool Self-Propelled Traffic Association, in respect of anything, or for any damage or injury caused to any person or thing, but that all responsibility of every sort and kind, whether pecuniary or otherwise, and all risk of damage to the competing vehicle, is to attach to the competitor, and is to be borne by him.

In making the awards, the judges—Everard R. Calthrop, S. B. Cottrell, Prof. H. S. Hele-Shaw, Prof. Boverton Redwood, Sir David Salomons and Henry H. West—will consider the cost, control, working and construction of the vehicles, and the particular points in connection with those propelled by steam, oil, or electricity, respectively.—*The Motor-Car Journal.*

## THE MOTOR "L'AIGLE."

In this motor the speed is regulated by acting on the exhaust in such a manner as to modify the lift of the valve without changing the movements of its opening and closing. The accompanying illustrations show how this is accomplished in the case of a two-cylinder vertical motor.

Figs 1 and 2 are side and end elevations, respectively, and Fig. 3 is an enlarged end view of the valve-operating mechanism; b $b^1$ are the valve boxes, and c $c^1$ the exhaust valve stems; d is the cam shaft and g is the governor, which is mounted on the cam shaft. The governor sleeve has formed on it a shoulder h of conical form, on which runs a roller i on an arm from the rocking shaft j, which is parallel with the cam shaft. On the shaft j, in line with each exhaust valve, are keyed two other arms, k, which have short links l pivoted to their upper ends and rollers m at the ends of the links.

The pieces u, pivoted at p, are worked by the exhaust cams r, and their motion is transmitted to the valve stems c c, through the medium of the rollers m. Evidently, therefore, when the rollers m are in the position shown by the full lines (Fig. 3) the lift of the valves will be at its maximum, and it will be a minimum when m is in the position shown by the dotted lines; and, moreover, the moment of opening and closing these valves will be unchanged in either case.

The drawings appear to represent the conical shoulder h as not completely embracing the governor sleeve, but there is no reason why it should not, and this is probably a draughtman's error.—*Adapted from La France Automobile.*

## MAGNALIUM ADOPTED IN DAIMLER VEHICLES.

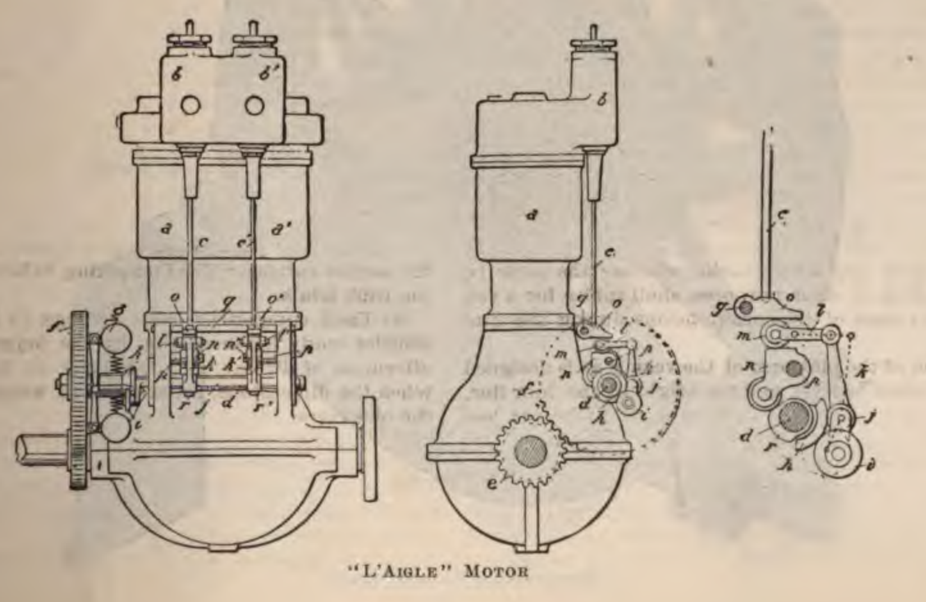
Paul Meyan, writing to *La France Automobile* from Cannstadt, near Stuttgart, reports that the Daimler Motorwagon Co. has definitely determined to adopt magnalium in the construction of both motors and vehicle frames. The composition and properties of this alloy were described in THE HORSELESS AGE of May 16, and may briefly be recapitulated as follows: Composition, magnesium, 25 per cent., aluminum, 75 per cent.; specific gravity slightly less than that of pure aluminum; tensile strength somewhat over 5,000 lbs. per square inch. It is readily cast, and can be machined without difficulty. In general physical characteristics it resembles hard bronze.

M. Meyan, describing it, adds that it can be brazed and soldered, and also punched and stamped in the sheet form. The comparative strength of magnalium and aluminum is indicated by the fact that when two similar bars were gripped in a vise, while the aluminum bar was broken at the first blow of a hammer, some ten hard blows were necessary to break the magnalium bar.

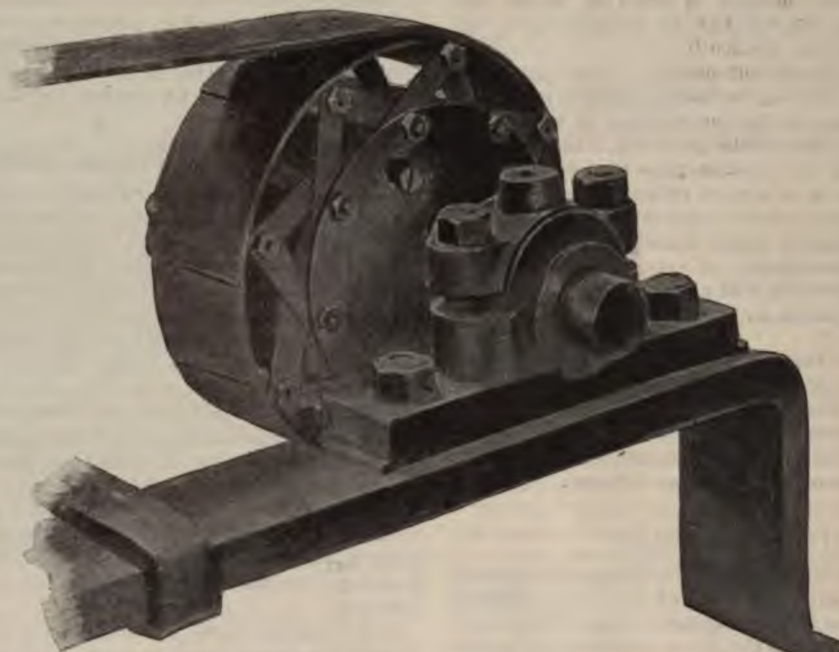
In connection with the intended use of the new alloy, the Daimler Co. has projected a number of radical improvements. The chief of these is a motor of novel design, built almost wholly of magnalium, and having mechanically-opened inlet valves, Bosch electric ignition, and an improved radiator, which will require the carrying of only six quarts of water for a 16 h. p. motor. Other features will be the use of an absolutely irreversible steering gear, a new brake mechanism and a lightening of speed gears and other parts, so that a 16 h. p. vehicle will weigh only 900 kilos or less than 2,000 lbs.

An extensive fire occurred a few weeks ago at the works of the Speedwell Electrical Motor Car and Cycle Co., Reading, England, by which they were practically destroyed.

The St. John's works of Starley Bros. and Westwood Mfg. Co., Coventry, England, have been acquired by H. J. Lawson in the interests of the British Motor Co.



"L'AIGLE" MOTOR



ROTTENBURG PULLEY, CLOSED.

ROTTENBURG PULLEY, OPEN.

## THE ROTTENBURG VARIABLE-SPEED GEAR.

An ingenious variable-speed gear exhibited at the recent show at the Agricultural Hall, Islington, is herewith illustrated. It is made by Rottenburg, of the Patella Works, Paisley. The gear consists of two automatically expansible pulleys connected by a belt. The driving pulley on the motor shaft is constructed with expanding and diminishing spokes, so arranged that the tangential pull of the driving belt tends to decrease the size of the pulley, while a very strong spring inside the latter tends to expand it. The periphery of the pulley is made in four segments of thin steel, suitably curved, and each overlapping the other. The tension of the spring can be adjusted so that the pulley can start closing at a certain fixed maximum load upon the belt. The driven pulley is constructed in a very similar manner to the driver, but the arms or spokes are so arranged that the pull of the belt tends to expand the pulley, so that the force exerted through the belt becomes greater, as it does in hill climbing, so the one pulley contracts —providing that the pull exceeds that arranged for the spring to withstand. The two pulleys are in the ratio of 1 to 3.3 to each other. The advantages claimed for the new gear are: (1) By setting the spring of the driving pulley to suit the most efficient torque of a given motor, the motor, except on a light road, will drive a car a given distance with the smallest expenditure of energy; (2) The driver does not need to keep on changing the gear on an undulating road—it sets itself to suit the gradient; (3) The driving pulley does not allow the belt to get slack.—*The Motor-Car Journal.*

## A MOTOR-CAR AS A SURGICAL DRESSING BOX.

From a French contemporary the *British Medical Journal* culls a remarkable instance of how Dr. Klein, while riding his motor car in the neighborhood of Sable, was able to be of assistance to a road mender who was found writhing by the wayside. On dismounting he at first sight diagnosed an epileptic fit, but after having had the sufferer carried to a neighboring farmstead, he discovered a strangulated hernia. The symptoms having existed for some 18 hours, and every ordinary method of reducing the rupture having failed, there was no resource but operation. The patient could not be removed on account of his weakness, and as his condition was becoming critical there was no time to return for anæsthetics and antiseptics. On looking at his motor car it suddenly occurred to the surgeon that in it lay the solution of the difficulty. He took from it some "essence" (probably the gasoline), and washed the field of operation; he drew off some water that had been condensed in the cylinders of the automobile, and was therefore presumably sterile; he took some of the alcohol carried for the lamps, with which he disinfected his hand, and in the flame of which he sterilized his instruments and commenced the operation. After making an incision over the abdominal ring just large enough to admit the tip of his finger, he cautiously passed along it the blade of a bistoury, with which he made a few small cuts, and dilated the parts with the other finger; the hernia was then successfully reduced. The wound was closed with an ordinary needle and thread sterilized in alcohol. He then took some of the cardboard and cloth which was carried to repair the joints of the waterpipes of the motor car, made these into a pad which he boiled in the "essence," and, after it had cooled, applied to the wound and kept in position with a towel. Two days later he returned to his patient to find the wound healed.—*The Motor-Car Journal.*

## RECENT FRENCH PATENTS.

VARIABLE-SPEED GEAR.

This invention is patented by Teste, Moret, et Cie., and its principal feature is the design of the friction clutches. Fig. 1 is a general plan view in section. Fig. 2 is a side view of one of the clutch rings. Fig. 3 shows the clutch ring in place in its shell, and Fig. 4 is a perspective view of the clutch ring.

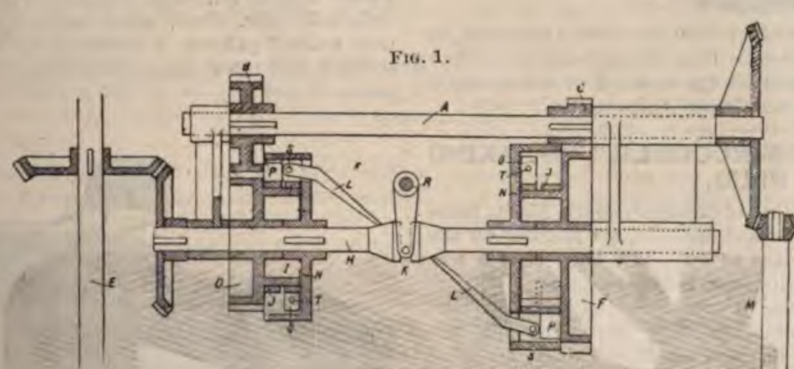
In Fig. 1 m is the motor shaft on which are keyed the high-speed pinion b and the low-speed pinion c; and e is the axle. The driven gears d and f have each a drum affixed to one side, which is gripped by the clutch ring, and shells n n surround the rings and are keyed to the shaft h. The clutch ring, are cut in a sort of spiral form, as shown in Fig. 4, and one end has an ear, o, which rests against an adjustable screw t, while the other, which is wedge-shaped, is acted upon by the short arm of the lever l. As seen in Fig. 3 the movement of this short arm, which itself is of wedge-shaped section toward the centre, forces the ear p to move so as to tighten the ring on the drum j.

A double cone or thimble k of the usual sort, shifted by the arm r, causes the one or the other clutch to engage, and in its middle position both clutches are free. The clutch for the high-speed gear is made somewhat smaller than the other, thus economizing in weight.

EXPLOSION MOTOR.

Patented by Gustave Gobron. This is a two-cycle motor whose leading feature is the design of the piston, which is

Fig. 1.



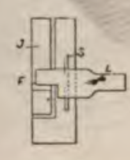


Fig. 2.

Fig. 3.

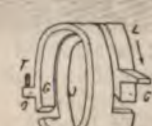
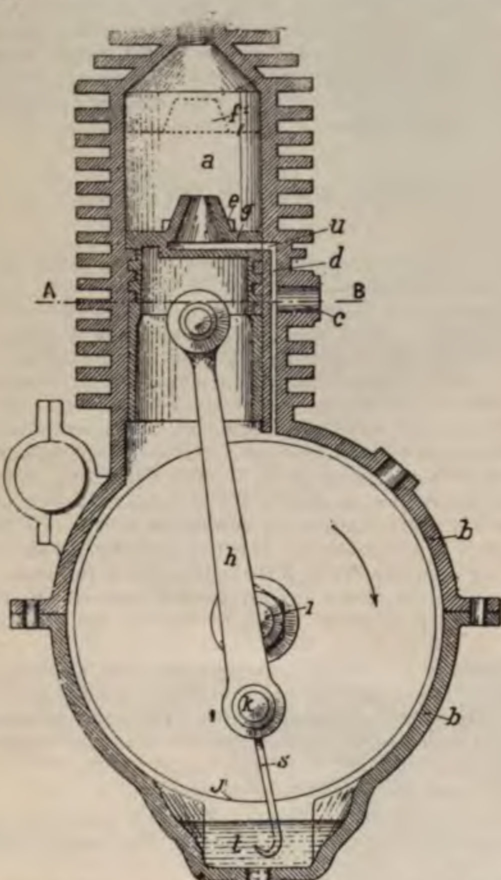


Fig. 4.

arranged to direct the entering column of mixture up in the centre of the cylinder, while the exhaust takes place below and on both sides. In the drawing c is the inlet port, d the transfer passage, and e (just visible on either side of the cone at the top of the piston) is one of the two exhaust ports. The head of the piston is formed with a passage g in it, ending in a conical opening, and after the exhaust has taken place the further downward movement of the piston causes the passage g to register with the opening up of the transfer passage d, which permits the fresh charge to pass from the crank case into the cylinder.




The axis of the cylinder is offset from the axis of the shaft, in accordance with a rather curious idea of the inventor's, that some power is thereby saved on the upward or compression stroke.—*Illustrations from La France Automobile.*

## THE CREST "INDESTRUCTIBLE" SPARKING PLUG.

The Crest Manufacturing Co., of Cambridgeport, Mass., manufacturers of Crest motors for automobiles, are putting on the market a radically new design of sparking plug, that is not affected by heat and expansion, and is unbreakable.

After a considerable expense in experimenting with the best porcelain of foreign manufacture, they have, through the assistance of a well-known chemist, discovered a new material that is unbreakable by heat or expansion. They have had these sparking plugs in use for a long time on their motors without any reports of failures, and have decided to introduce them to other manufacturers and users of other makes of motors.

It is well known that the sparking plug is a delicate piece of mechanism and gives considerable trouble, and the failure of motors can, as a rule, be traced to the failure of the plugs, and for this reason all automobilists are compelled to carry one or two spare plugs in their kit.

Although the jump spark method is the most largely used today, on account of its simplicity, it would be universally used in preference to the contact and wipe spark methods if it were


not for the troubles of the plug, with its liability to crack with the intense heat of the motor, short-circuiting the secondary circuit.

The material used in this plug is a perfect electrical non-conductor, and does not expand under intense heat. It is tough, and not brittle like porcelain. The sparking plug, as shown in the cut, consists of a shell of steel having a thread at one end to screw in the orifice of the chamber of the motor.

The plug proper consists of a light cone of this new material, which is inserted in the steel plug. This cone fits tight in the shell, making a gas-tight joint, without packing, unlike all other forms of sparking plugs, as they use packed joints, which, in the hands of unskilled persons, are apt to cause failure in the working of the motor. Through this cone a wire is passed, terminating at the bottom of the plug with an enlarged head. A platinum wire is inserted in the body of the steel shell, the spark jumping across between the two points.

## THE FRIEDMAN AUTOMOBILE.

The Friedman Automobile Co., 236-240 Carroll Ave., Chicago, send us a pamphlet describing their machine, which is illustrated herewith. The motor develops 3 h. p. and has two opposed cyclinders of the four-cycle type. The water tank is located over the rear driving wheel and holds 6 gallons. Circulation is by gravity. The drive is frictional, with reverse. The wheels are 30-in., with 2½ and 3-in. tires, and the whole weighs 550 lbs. Jump spark ignition is used, and the gasoline tank holds 5 gallons. A maximum speed of 25 miles on a level is claimed, and the company is selling the vehicle at a very low price.

# MINOR MENTION

The Auto-Manufacturing Co., of Philadelphia, has been incorporated.

An automobile club has been organized at Syracuse, N. Y., with 19 members.

There is talk in Chicago of requiring all motor vehicles there to be equipped with fenders.

The Locomobile Traction Co., of New York, has been incorporated in West Virginia.

The Wood-Gleason Motor Carriage Co. has been incorporated in Kittery, Me. Capital $500,000.

The Altha Automobile & Power Co., of New York, has been incorporated under Delaware laws. Capital $500,000.

The name of the Slaymaker-Barry Co., Connellsville, Pa., has been changed to the Baldwin Automobile Manufacturing Co.

The Chicago Carette Co. intends to replace its present equipment with motor vehicles. and will give both steam and electricity a trial.

Complaints of fast driving have led the directors of the Boulevard Association, Syracuse, N. Y., to consider the advisability of barring motor carriages from the Boulevard.

The Automobile Club of Philadelphia has been chartered. It has now 42 members, and a committee has been appointed to find a suitable site for a clubhouse and stable.

Bridgeport, Conn., will have automobile races on the opening day of the State Fair, Sept. 24, instead of bicycle races. Two thousand dollars will be given in purses and prizes.

The Newark, N. Y., officials have decided that an automobile is subject to the same law as traction engine, and should be preceded by a watchman an eighth of a mile ahead. Automobilists should take warning.

An electric carriage in Los Angeles, Cal., happening to strike a delivery wagon broadside on, overturned the wagon, climbed over it and resumed its course on the pavement (so it is reported) without damage.

Col. Renard has invented a light motor for military traction which is to be tried in the coming French Army manœuvres on the plain of Beauce. It has a new feature in a stiff spiral coupling for the wagons, permitting the motor to haul thirty of them on a winding road.

The authorities of Yonkers, N. Y., have decided that a boiler license issued by the local inspector will be required of all operators of steam carriages within the city limits. As many of these vehicles are now operated under licenses issued by New York inspectors it is likely that a protest will be made

A collection of military automobiles is to be shown at the Paris Exhibition. These will include postal and telegraph cars, omnibuses for personnel, cars for the commander and his staff, motocycles for carrying dispatches, medical wagons, etc., as well as heavy traction engines. As a rule army automobiles are painted gray.

A member of the Automobile Club of America, one of whose tires lately sustained a bad gash from a broken bottle while near Woodhaven, L. I., patched the cut after the local bicycle repairer had given it up in despair by using a section cut from the inner tube of a bicycle tire. The rubber tube just fitted the inside of the carriage tire.

C. S. Henshaw will enter a De Dion voiturette in the Bridgeport *Post* and *Telegram's* automobile parade on July 4, and will also bring three tandem racing machines with De Dion motors which will appear in the parade, and in the afternoon will participate in a one-hour paced race at Pleasure Beach, and probably also in a five-mile motor tandem race, at which an attempt will be made to lower the record. J. A. O'Brien, of Bridgeport, has offered a silver cup for the best mile made by an automobile at Pleasure Beach on that day.

C. J. Field, the vice-president and general manager of the De Dion-Bouton "Motorette" Co., has just returned from a successful trip to Paris. He has closed arrangements, with Mr. Skinner's assistance, to control the De Dion-Bouton & Co.'s patents for this country, and the "Motorette" Co. will commence at once the manufacture of the motor vehicles of the De Dion type in this country, and the sale of the De Dion motors as the sole general agents and licensed manufacturers for the United States. In next week's issue we will give the full details of this deal. Mr. Field has brought back with him a full line of the De Dion "Motorettes" as samples, etc.

There have been several races of late between owners of motor carriages in the streets of Newton, Mass. Owing to the strictness of the police in enforcing the speed regulations, an early hour has been chosen for these races, they being run off between 5 and 6 a. m. The riders, many of whom are Harvard students, have supposed that no objection would be raised to this, and there has been no effort at secrecy; but complaints were made by several citizens on the announcement of one race recently and the police had no option but to stop it. Two or three riders were arrested, and unless an adjustment of the difference be found the racers may have to go somewhere else for future sport.

## MOTOR VEHICLE CAPITALIZATION.

The formation of automobile companies has been so frequent lately that the announcement attracts no attention now. Within the past six months, however, a marked increase in the usual number of incorporations has been noticed. It is estimated that the number of such companies having a corporate existence under the laws of New Jersey, Delaware, West Virginia and other charter-making States, is considerably over 500. New York City and the Eastern States seem to be the favorite field for these inventions.

The combined capitalization of all these companies, as taken from the records of the different States, is approximately $500,000,000, and it is conceded represents little more than the paper on which it is written.

Authorities familiar with the automobile situation state that there are only 31 concerns which are actually engaged in the manufacture of automobiles for sale. The total amount of capital involved in the manufacture by these concerns does not exceed $10,000,000. The balance of the capitalization, about $490,000,000, represented in the chartered capital stock, represents the hopes of the inventors.

In addition to the large number of concerns, of which there is a state record, there is a still larger number which exists as copartnerships or firms. These companies possess patents of mechanics who have been studying the movement with the hope of giving the world some new invention.

The *Commercial's* informant states that there is hardly an inventor of any prominence who is not more or less engaged in perfecting the automobile. At the Patent Office in Washington the applications for patents on different parts of the automobile are so numerous that it exceeds the activity which existed when the bicycle began to make its appearance in general use.—*The N. Y. Commercial.*

# MOTOR VEHICLE PATENTS ∴ ∴ OF THE WORLD ∴ ∴

## UNITED STATES PATENTS.

650,839—Steering Mechanism for Automobiles.—H. E. Heath, of Windsor, Conn., assignor to the Eddy Electric Mfg. Co., of same place. June 5, 1900. Application filed Jan. 17, 1900.

A series of cam movements for swiveling the steering axles. The cams are supposed to be self-locking, and the drawings explain themselves.

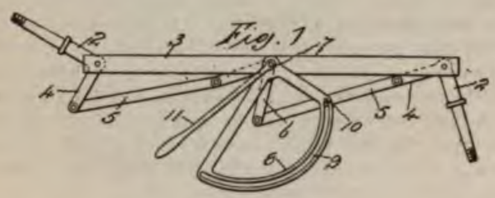


Fig. 1

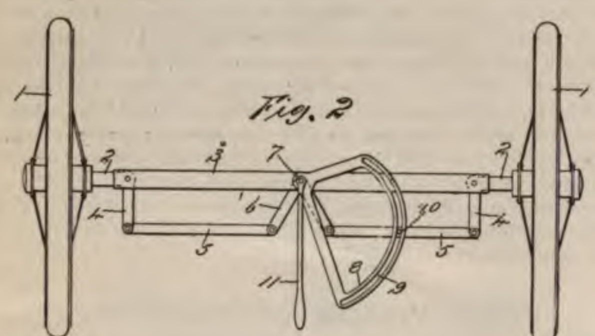


Fig. 2

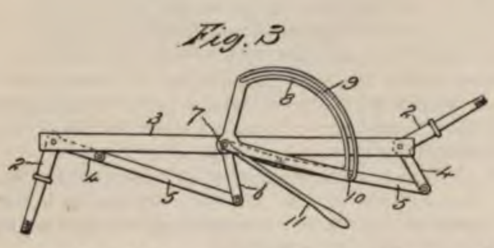


Fig. 3

650,840—Steering Mechanism for Motor Vehicles.—H. E. Heath, of Windsor, Conn., assignor to the Eddy Electric Mfg. Co., of same place. June 5, 1900. Application filed Nov. 15, 1899.

This is a power-steering device for heavy wagons. The front axle is arranged with a fifth wheel, and is turned by an independent electric motor, 10, actuating a worm and wheel. Attached to the turntable or swiveling portion of the fifth wheel is a controller switch, shown at 11 (Fig. 3), provided with contacts 13 and a neutral middle portion where no contact is made. The contact arm 14 is moved over these contacts by the hand lever 21, and the current, flowing via said contacts through the motor 10, causes the front axle and turntable to be swiveled in the corresponding direction. This motion of the turntable carries the switch 11 with it, and when the neutral position is reached the circuit is broken and the current ceases to energize the motor. A turn of the hand

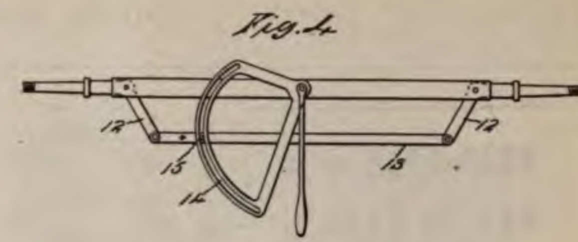


Fig. 4

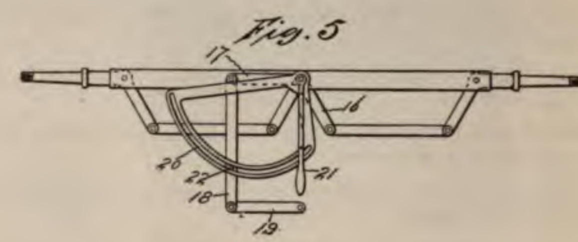


Fig. 5

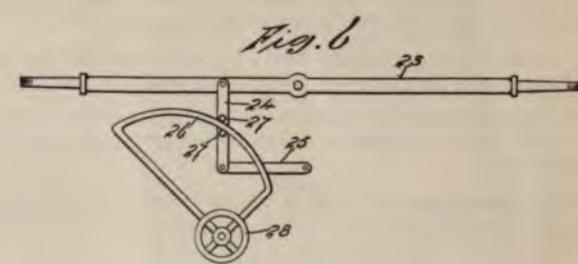


Fig. 6

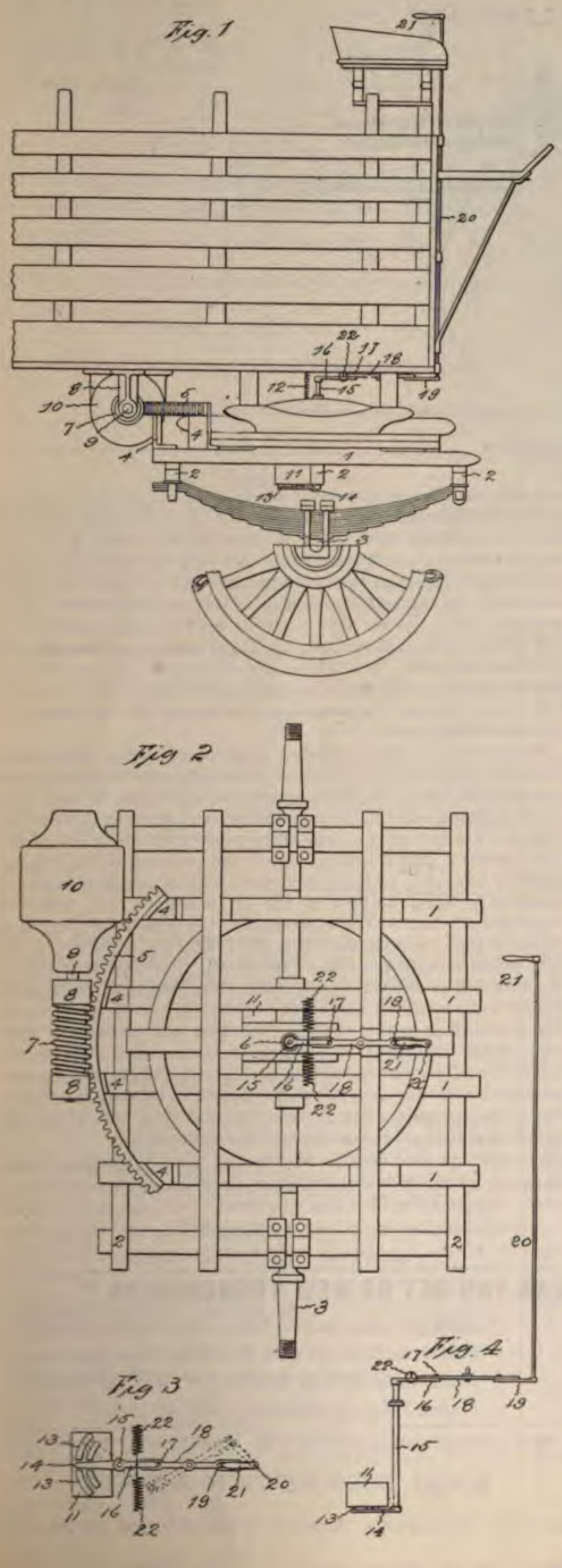
lever 21 in the opposite sense causes the axle to be swiveled in the other direction. When the hand lever is released the springs 22, 22 tend to draw the switch arm into the straight-ahead position, which is therefore automatically maintained.

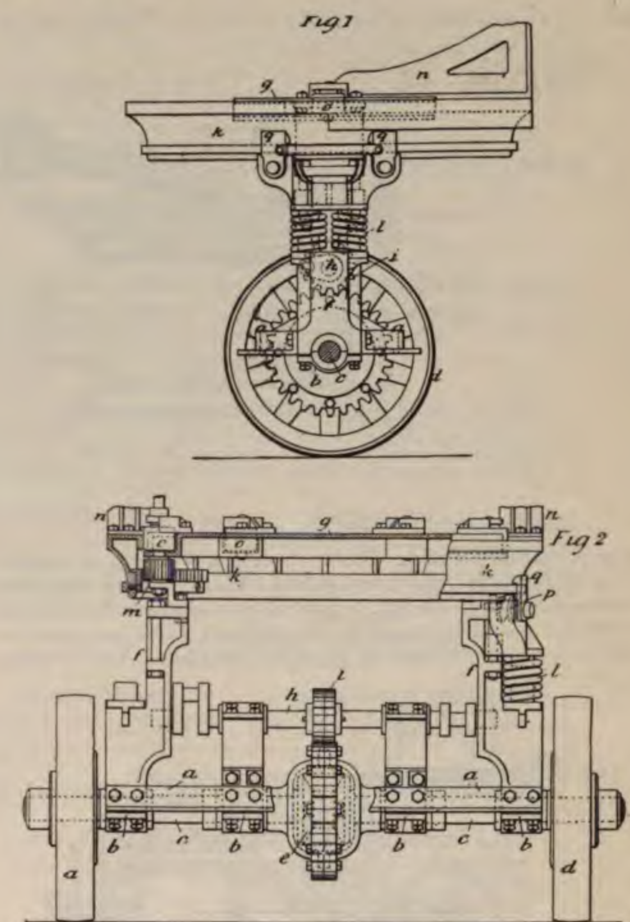
651,062—Internal Combustion Engine.—Alfred Adamson, of Lynn, Mass. June 5, 1900. Application filed Oct. 14, 1899.

A two-cycle engine with separate pumping cylinder, and a low-pressure cylinder for prolonged expansion.

651,197—Motor Car.—Jean Molas, of London, Eng. June 5, 1900. Application filed March 9, 1899.

In this invention the fifth-wheel takes the form of a large turntable or circular platform g, guided by a fixed ring k, and supporting the weight of the vehicle on rollers. Fig. 1 is a side view, and Fig. 2 is a front view, partly in section; a is the underframe, which has four bearings b, two for each of the axles c of the driving wheels d, these two axles being connected through a differential gear e of ordinary kind. At each end of the underframe a there is a pedestal f, which supports a circular platform g for the driver. In the pedestals f are bearings for the ends of the shaft h, which may be, as shown, a crankshaft having a pair of cranks worked by a pair of engines, or may be the shaft of an electric motor without cranks, the engines or motor being carried by the platform g. On the middle of this shaft is fixed a pinion i, which gears with teeth on the periphery of the box which incloses the differential gear and has bearings for the bevel-pinions. The ring k is carried on springs l, resting on the pedestals f, and it has part of its internal circumference toothed to gear with a pinion m on a vertical steering shaft. The ring k is attached by angle-brackets n to the front of the omnibus or vehicle which it is intended to draw. The rollers o p guide the platform g horizontally and vertically as it revolves within the ring k. On the





651,197. Motor Car.

axis of the rollers p are hooks q, which engage over a rib projecting from the ring k and prevent it from being raised too high by the springs l.

651,216—Gas Engine.—F. W. Toedt, of Hamburg, Ia. June 5, 1900. Application filed Aug. 5, 1899.

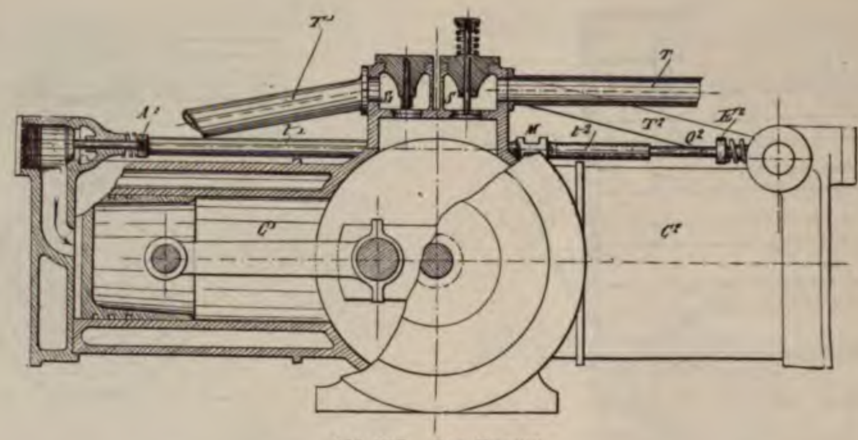
651,237—Gas or Petroleum Engine.—Henry Crouan, of Clichy, France, June 5, 1900. Application filed Jan. 3, 1899.

The object of this invention is to increase the power of explosion engines by introducing into the cylinders a larger quantity of mixture than would be drawn thereinto by suction alone. To this end a two-cylinder motor of the opposed type is preferred, with both pistons approaching the crank shaft and receding from it simultaneously.

The figure shows an inclosed crank case, with a supply valve S opening into it, and a transfer valve $S^1$ leading from it to a transfer pipe $T^1$, which leads to the inlet valve $A^1$ of the cylinder $C^1$. A similar transfer valve and pipe carry the mixture, on alternate revolutions, to the cylinder $C^2$. As both pistons move out and in together, it is obvious that a double charge will be drawn into the crank-case; and as while one cylinder is drawing in its fresh charge an explosion stroke is taking place in the other, evidently the mixture from the crank-case will find its way only to the destined cylinder, which will therefore take in fresh mixture till an equilibrium of pressure is established between the crank-case and the cylinder.

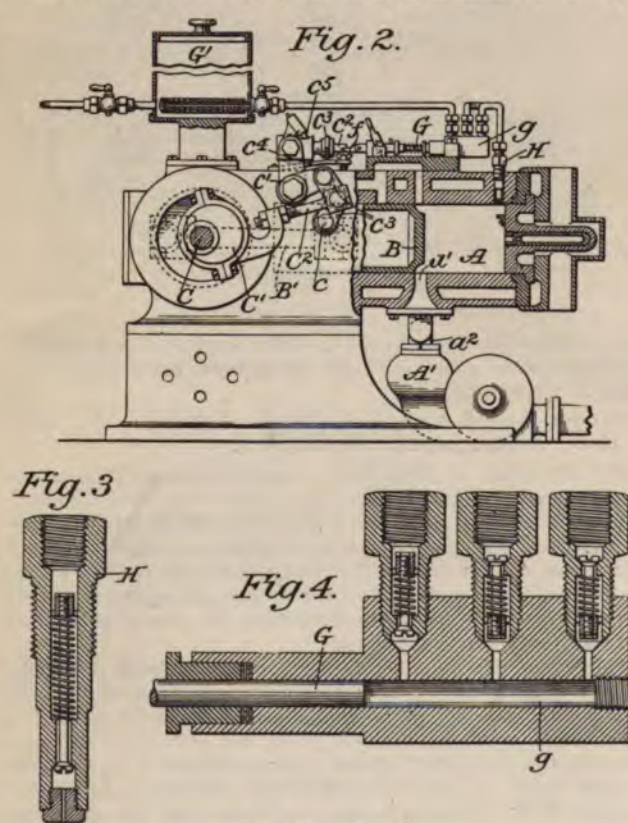
651,317—Engine.—C. W. Weiss, of New York, N. Y., assignor of one-half to August Mietz, of same place. June 5, 1900. Application filed Jan. 16, 1899.

This is a device for feeding oil to the several cylinders of a multi-cylinder engine, and to accomplish this without the use



651,237. Gas Engine.

of duplicate mechanism. In the figures it is shown as applied to a two-cylinder two-cycle engine whose impulses occur on alternate strokes. In Fig. 4, g is the oil-pump cylinder, having a plunger G, and oil enters by the left-hand valve and goes to one or the other cylinder by the two right-hand valves. The




651,317. Engine.

plunger G is arranged so as to deliver as many double strokes during the complete cycle of the engine as there are cylinders coupled together—in this case two. As represented in the drawings, an eccentric $C^1$ is mounted on the crank-shaft, and its rod $C^2$ is connected to the middle joint of a pair of toggle-levers $C^3$. One end of the pair of toggle-levers is pivoted at a fixed point, and the other is connected to one end of a bell-crank lever $c^1$. It will be seen that the forward movement of the eccentric-rod rocks the bell-crank lever, as does also the return movement, so that the bell-crank lever receives two movements for each rotation of the crank-shaft. A rod $c^2$ is connected to the lever $c'$ and carries a flat-faced nut $c^1$, which rests upon an incline $c^4$. When the engine is running at normal speed, the end of the rod $c^2$ strikes the end of a tongue f, which is operatively connected with the pump-plunger and actuates the same; but when the engine is running too fast the momentum of the rod and the nut as the latter travels up the incline will throw the end of the rod above the end of the tongue and the plunger will be unaffected. A retarder may be carried by an arm extended from the bell-crank, as indicated at $c^5$, to bear upon the rod $c^2$ and prevent the same from flying up too far when the engine is running very fast.

As stated, the pump-cylinder is connected with the several single engines; and the effective movement of the pump is so arranged in the particular construction shown as to take place as each piston reaches the forward limit of its stroke, at which time the exhaust-port $a^1$ has been opened by the forward movement of the piston B beyond it and the pressure in the engine-cylinder has fallen practically to zero, so that there is no back pressure to resist the flow of the oil, which is then delivered into the cylinder. At the same instant the pressure in the other engine cylinder or cylinders is sufficiently great to shut off the delivery of oil into the same. It follows, therefore, that the oil or other fuel is delivered only into that cylinder which is in readiness to receive it and at the instant when it is required. The injection or delivery of the fuel does not necessarily take place at the instant of the opening of the exhaust; but as the fuel follows from the regulating device the path of least resistance both cylinders may be under pressure, though not under the same pressure. Fig. 3 is a detail of the valve H at the point where the oil is injected into the cylinder.

651,323—Motor Vehicle.—T. B. Dooley, of Malden, Mass., assignor to E. D. Wiggin, trustee, of Boston, Mass. June 5. 1900. Application filed Jan. 19, 1900.

652,064—Wheel Tire.—Paul Weinholt, of St. Louis, Mo. June 19, 1900. Application filed April 19, 1900.

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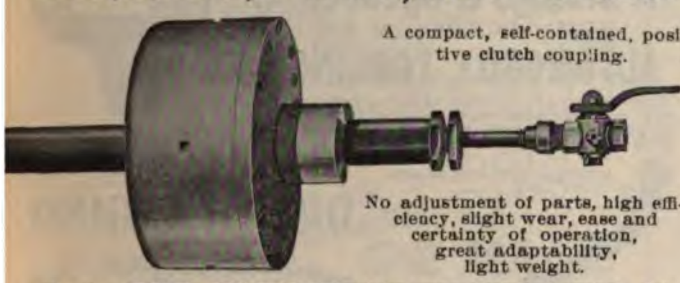

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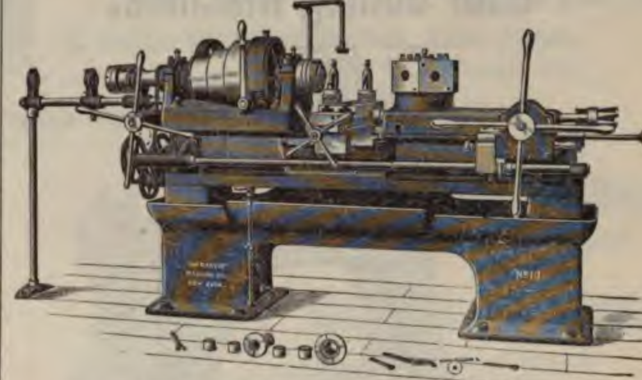

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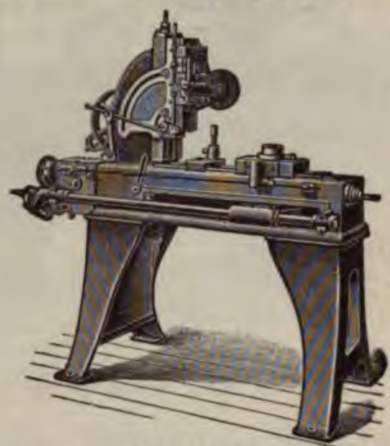

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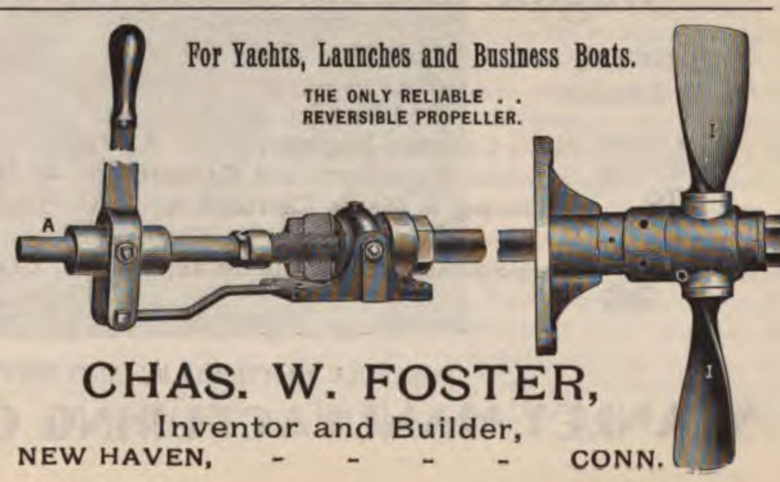

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# THE HORSELESS AGE

...EVERY WEDNESDAY...

Devoted to Motor Interests

VOLUME VI NEW YORK, JULY 4, 1900 NUMBER 14



## THE HORSELESS AGE.

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### GOOD ROADS INDORSED.

THE agitation for good roads receives recognition in a plank of the Republican platform adopted at Philadelphia. The plank reads:

"Public movements looking to a permanent improvement of the roads and highways of the country meet with our cordial approval, and we recommend this subject to the earnest consideration of the people and the Legislatures of the several States."

Planks other than political are apt to suffer much nelgect till they have been seasoned by several campaigns, and the above recognition does not come too soon. Those interested in good roads should use it as a fulcrum and press the agitation into Congress. Bad roads cost more in the wear and tear of the vehicles and horses that traverse them than would be expended in maintaining good roads, and a rational move forward cannot come too soon.

### THE LIMITATIONS OF SPEED LIMITS.

WE believe that in the majority of those cases, now so frequent where demand is made, that the speed of motor carriages be restricted by legal enactment, the main purpose of the protestants is to prevent these machines from frightening horses. This, of course, is not the case in large cities, where automobiles are by this time so common that the horses, seasoned already beyond the point of being startled by merely novel sights and sounds, rarely take notice of the new machines. But there are not as yet many cities of which this is true, and except in isolated cases we have not reached the point where our urban *chauffeurs* are willing to charge through the streets at more than trolley-car speed, scattering pedestrians and endangering other vehicles for the sake of the agreeable diversion thus afforded.

With all their hustling and their pride in being "at the head of the procession," the Americans are, as a race, essentially law-abiding, and it would not be in keeping with the national character for those individuals in the community, who happen to own motor carriages, to challenge the justifiable resentment of the majority.

It therefore happens that, while instances are reported every now and then in which the disregard of the public's rights, shown by some few individuals, has compelled the enactment of speed limits covering all, yet these cases are comparatively few in comparison with the number of pedestrians and motor vehicles involved; while, on that basis of reckoning, much the more numerous protest comes from the smaller towns where automobiles are rarely seen, and in which they are still more rarely owned. In these latter cases the disturber of rural tranquility is usually the property of one of "them city fellers;" and the man with the hoe, whose placid nag never saw either a purple cow or a trolley car, not unnaturally views the advent of the "devil wagon," leaving a column of dust in its wake and impairing the "permanent psychic equipment" of his beast, as a noxius invasion to be resisted by all available means.

Now, it is to be granted at once that it is quite possible to run a motor carriage too fast, even on an open road, for the safety of the occasional other vehicles to be met with. Moreover, the temptation to run too fast, given a fairly good road, is much greater in this case than in the city, because of the greater distances, the absence of cross streets and the fewer teams. But although the temptation is greater, it is a distinct

misfortune that it should be yielded to. Driving at a speed which is made reckless or inconsiderate by the attendant conditions is not less reprehensible in the country than in the city, and it can do quite as much to damage the prestige and check the progress of the motor vehicle.

Again, it may very likely be true that a horse is frightened more by the rush of a vehicle past him at high speed than when a policy of delay is adopted. This does not appear to be proven, however; and some operators claim that their experience has been directly the contrary, arguing that they get well past the horse before his terror has time to develop. Whichever course a rider has found to frighten the animal less he should feel morally bound to pursue in all cases where the horse shows alarm. It is well enough in cities to say that the timidity of the horse is notorious, and that he who drives one takes his own chances. The horses of the city are not so easily frightened. But the fact remains that the horse is our almost universal beast of burden. Many people could not discard him if they would, and if they did they would not be able to manage a motor vehicle. The horse is with us of necessity more than of choice, and while the motor vehicle owner may pity the horse owner, he is yet bound to treat him with reasonable consideration.

The point we wish to make, however, is the futility of a legal speed limit on motor carriages as a preventive of horse runaways. Who, to begin with, is prepared to say that the equine species will usually take fright at an automobile driven, let us say, at 15 miles per hour, but will not take fright at one driven at a 10-mile gait? And if this, or something equivalent, were asserted, what would be done with the intermediate speeds? It is a fact that in a large number of the runaways that occur, especially in the country, the blame lies with the driver of the animal, who is giving more attention to the motor carriage than to his horse. Certainly a reduction in the former's speed would not diminish the number of "accidents" such as these. In very many cases the horse will take fright even at a standing automobile with quiescent machinery. In a case reported not long ago from a Long Island town, the motorist stopped on approaching a horse vehicle, and the driver of the latter got out and held the animal's head, telling the motorist to go ahead. This was cautiously done, but the horse escaped control, turned half around, and overturned the buggy with fatal results to one of the occupants. And yet this same town, as the direct result of that occurrence, is agitating the subject of a speed limit! It will be of interest to know what limit is fixed upon.

Considered simply as a preventive of runaways, a speed limit is certainly as crude a device as could well be imagined. In its least unreasonable form it should be drawn so to regulate speed only when passing a horse vehicle, and we think it should be considered rather as a standard by which to fix responsibility than as a preventive. Thus, if a horse runs away when an automobile is passing at a rate of no more than ten miles an hour, the inference is reasonable that the blame rests on the horse or on its driver, whereas a runaway due to a higher speed might be charged against the auto. Under such a law prosecutions would hardly be made where no accident resulted from a speed above the legal limit, and in that way the law would automatically become a dead letter when no longer required.

## CALL A MEETING.

THE HORSELESS AGE continues to receive letters from manufacturers of gasoline carriages, advocating concerted action with reference to the Selden patent and the attempt of the Lead Cab Trust to intimidate builders and gobble up the industry by its means. Herbert M. Sternbergh, of the Duryea Power Co., writing to one of our correspondents, urges that a meeting of the manufacturers interested be held at some central point, at which a common course of action may be resolved upon and a fund started for the mutual defence. Such a meeting should be held without delay. It is very probable tha the first gun fired by the Trust will be in the nature of an attack on one of the weaker companies, and it is of prime importance that the interests of the industry be not sacrificed in this first action for the want of adequate defence.

THE Rochet motor, described in our Foreign Exchanges columns this week, appears to be of excellent design, but the vehicle itself is a very complete exemplification of the besetting sin, in France, of undue complexity in controlling mechanism. One two-handled steering bar, two hand-operated levers, two hand-operated motor regulators, three pedals, and a hand-operated safety catch. Think of it! No wonder that automobile driving is considered an acquired art in France, to be won only by persistence and rigorous drill on specially-equipped training tracks.

THE Examiner of Stationary Engineers in Buffalo, N. Y., wants to see the present engineers' license law applied to all motor vehicle operators. This would result in restricting the right to use these vehicles to regular locomotive and stationary engineers, and would debar all women. What have stationary engines to do with automobiles anyway, we should like to know? And what have steam engines to do with gasoline and electric motors?

## AUTOMOBILE RACING IN NEWTON.

There is a feeling among the would-be racers whose sunrise contest on the Newton, Mass., Boulevard, June 23, was suppressed by the police, that bad management more than anything else was responsible for the untoward result of the race. A well-known Newton operator, who assured the racers at the start that the police would not interfere, is said to have interviewed only the Chief of Police on the subject, and not the Mayor also, as should have been done. The headlines in some of the Boston papers on the day after the first race along the Boulevard, a week previous to the one which was stopped, seemed to indicate that the racers had outwitted the police, and had eluded them, though as a matter of fact the police were not intending to interfere unless the speeding took place after 6 o'clock; and this slighting reference, it is said, stirred up the Mayor so that he called the matter to the Chief's attention. A secondary reason was the fact that there has been so much speeding of steam carriages in the daytime in Newton lately that certain people who do considerable driving have been much annoyed, and have on their part, also, brought speeding in general to the attention of the authorities.

In a recent interview the Chief admitted freely that, so far as

the actualities of the case were concerned, there was no danger of any annoyance to other vehicles on the Boulevard so early in the morning, for the reason that before 6 o'clock practically no vehicles are out on that roadway.

It may be of some interest to automobilists to know that it is not out of the range of possibility to secure a permit for a road run on the Boulevard. The police, however, are not the people to whom the application should be made. The police, in default of special instructions, are obliged to enforce the ordinances, and one of these prohibits the speeding of vehicles on the city streets and roadways faster than 10 miles an hour. But the Mayor and aldermen may allow special privileges as regards speeding. In such a case the police, instead of stopping the racers, assist in keeping the way clear for them, and thus help to do away with danger from accidents.

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Grout Bros., Orange, Mass., are making the steam carriage shown in the accompanying photograph. Its general design is on the lines made familiar by the "Locomobile." The front spring is a reversed elliptic, and the frame also shows minor modifications. The engine has a phosphor bronze frame and cylinders of gray iron, the other parts being drop forged steel. The boiler is of copper, with 300 tubes and 45 sq. ft. of heating surface, and is hydraulically tested to 600 lbs. The working pressure is 165 lbs., controlled by automatic regulator, and the safety valve is set at 225 lbs. The water pump is worked by the engine and can be regulated by the operator.

## MOTOR VEHICLE CHARTS.

BY EUGENE HIGGINS.

The accompanying charts are designed for the purpose of quickly solving many of the calculations necessary in motor vehicle design. Chart No. 1 shows the relation of the speed of the vehicle in miles per hour, the diameter and revolutoins per minute of the drive wheels, and the ratio of speeds of the countershafts or motor shaft to the drive wheels.

Chart No. 2 shows the relation of the speed of the vehicle to the traction, the percentage of gradient and horse-power required under various conditions.

The chart makes no allowance for the air resistance, and an additional amount of power is required when it is met with.

To illustrate the use of the charts, let us assume a vehicle whose drive wheels are 32 in. in diameter, going at a speed of 15 miles per hour, the motor making 4 revolutions to 1 of the drive wheels.

From Chart 1 it will be found that the intersection of the vertical line representing 15 miles per hour, and the diagonal line representing a wheel 32 in. in diameter, corresponds to 157.5, the revolutions per minute of the drive wheel.

To find the speed of the motor, find the intersection of this same horizontal line with the diagonal line 4—1, representing the ratio of the speed of the motor to the drive wheel, and follow vertically down to the botom of the chart, where the revolutions per minute, 630, may be read.

The ratio of speeds may obviously be found in a similar manner if it is desired to run the motor at a certain speed.

To ascertain the power required per hundredweight of the vehicle and its load, it is necessary to know or assume the traction and the gradient. The traction is represented on Chart No. 2 as a certain percentage of each hundredweight of the vehicle. Let us, for instance, find the required horse-power for a vehicle going at 15 miles per hour when the traction is 10 lbs. per hundredweight, or 10 per cent.

The horizontal line at the intersection of the lines representing 15 miles per hour and 10 per cent. is .4 or .4 h.p. per hundredweight.

If the weight of the vehicle and its load is 6 cwt., then the total horse-power required is $6 \times .4 = 2.4$ h. p. If in the above case the vehicle is ascending a grade of 5 per cent., add together the 10 per cent. and gradient 5 per cent. and solve as before. The result will be 6 h.p. per hundredweight, or $6 \times .6 = 3.6$ h.p. instead of 2.4 as previously found.

The chart may be used conversely. For instance: At what speed can a vehicle and load weighing 8 cwt., propelled by a 4-h.p. engine, ascend a 15 per cent. grade, traction being taken as 10 per cent.? The sum of $10 + 15 = 25$ per cent.

The horse-power per hundredweight $= \frac{4}{8} = .5$ h. p. At the intersection of the lines representing 5 h. p. and 25 per cent. resistance, is the corresponding speed of 7.5 miles per hour—the result sought.

When descending a grade subtract the percentage of gradient from the traction and proceed as before.

A transparent ruler laid along the diagonal lines will prevent confusion when solving problems on the charts.

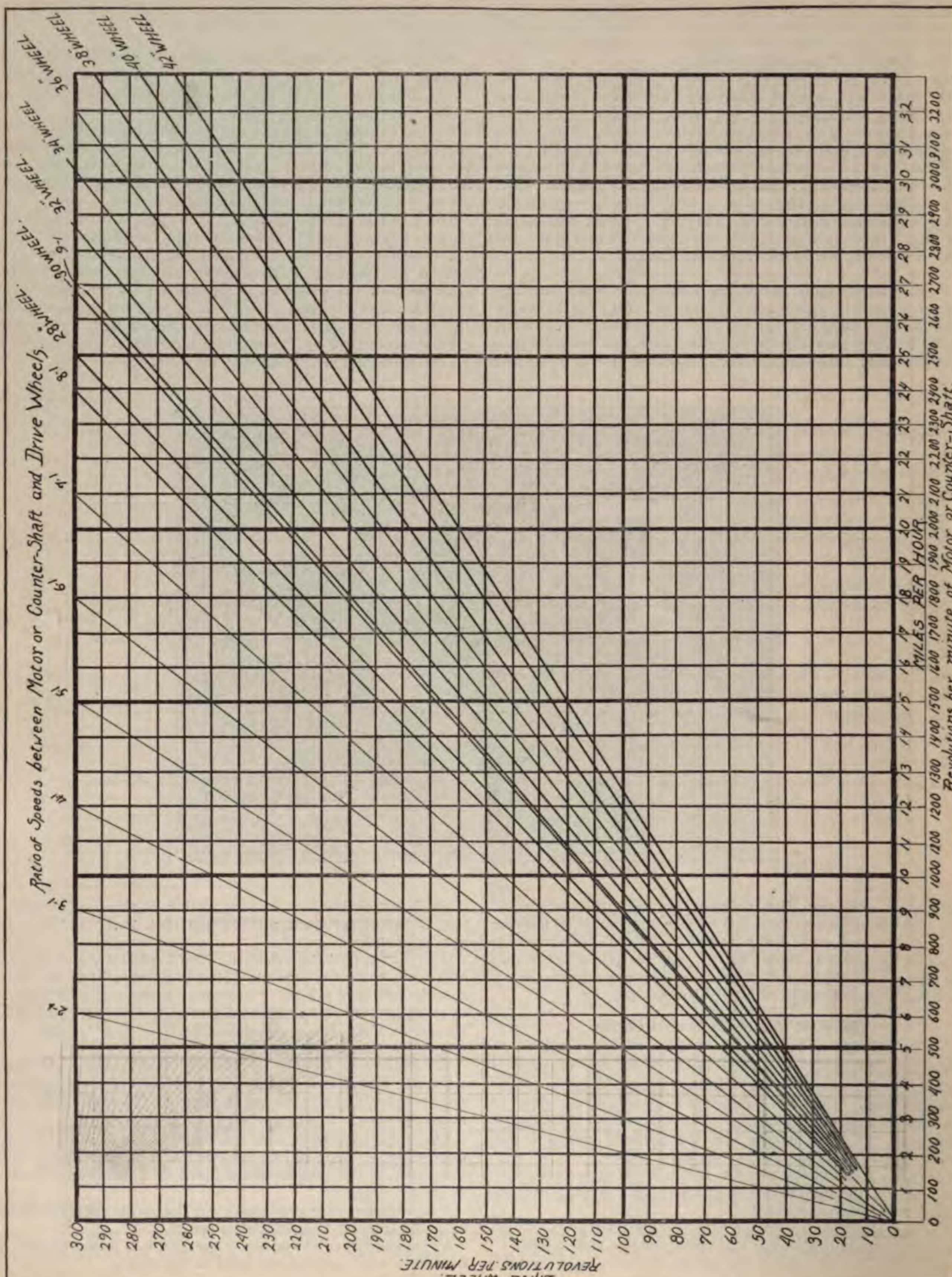

Ratio of Speeds between Motor or Counter-Shaft and Drive Wheels
28" WHEEL
30" WHEEL
32" WHEEL
34" WHEEL
36" WHEEL
38" WHEEL
40" WHEEL
42" WHEEL
MILES PER HOUR
Revolutions per minute of Motor or Counter-Shaft
DRIVE WHEEL.
REVOLUTIONS PER MINUTE.

CHART NO. 1.

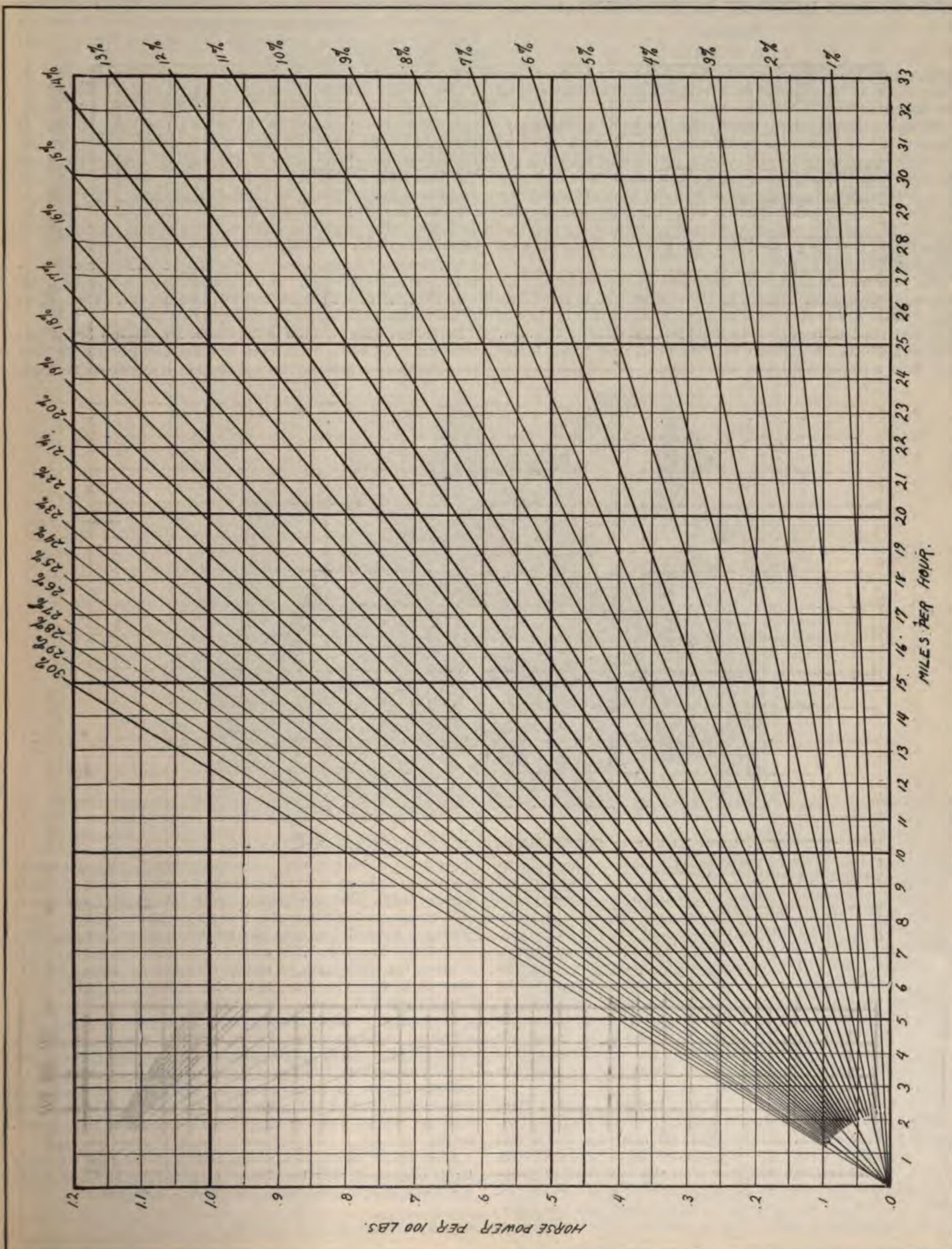

1% 2% 3% 4% 5% 6% 7% 8% 9% 10% 11% 12% 13% 14%
15% 16% 17% 18% 19% 20% 21% 22% 23% 24% 25% 26% 27% 28% 29% 30%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
MILES PER HOUR.
0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2
HORSE POWER PER 100 LBS.

CHART NO. 2.

## THE GORDON BENNETT INTERNATIONAL CUP RACE.

BY P. M. HELDT.

The results of this race are, of course, known in America, but a few observations made at short range might be of interest to the readers of THE HORSELESS AGE.

The race was less international than its name would imply, three of the five participants starting being French, so that, granting equal value to each of the racers, and applying the theory of probability, we should have reached the conclusion that France had greater chance of winning than of loosing the cup race. The internationality soon vanished entirely, on account of accidents sustained by the vehicles of the two foreigners, and the race finished as a match between two business partners—Charron and Girardot.

The race was run between Paris and Lyons, and the club whose representative arrived at Lyons first was to retain the cup. One of the conditions laid down by the donor of the cup was that the distance covered should not be less than 550 h. m. (344 miles). As the distance between Paris and Lyons is less than this, a roundabout way was taken.

The start was given at the Parc St. Cloud, on the road to Versailles, at 3 o'clock in the morning. A couple of hundred of spectators were present. Eight racers had been entered for the course, three French, three Belgian, one American and one German. None of the Belgian vehicles had arrived on the day of the race, and the only participant of the Belgian contingent, M. Jenatzy, who will be remembered in connection with the kilometre championship and his torpedo-shaped vehicle, the "Jamais Content," started with "any which" vehicle, as he said. Objection was at once made, it being claimed that the tires of M. Jenatzy's vehicle were of French make, while the conditions of the race stipulated that the vehicles should be entirely the product of the country, which they represented. Nevertheless M. Jenatzy started.

Herr Engen, who was to represent Germany with a Benz vehicle, withdrew at the last moment. The Benz Co. had expected to have a 30 h. p. racer ready for this race, but it was not completed in time. Herr Engen intended to take part with a 15 h. p. vehicle which last year won the race Berlin-Leipsic. He withdrew, giving as an excuse insufficient time for preparation. The official authorization was obtained only three days before the race took place. Before this time it was extremely questionable whether the race would be run. M. Jenatzy and a number of other Belgian present also talked of addressing a formal protest to the Automobile Club against the too short time allowed for preparation.

The three French participants, Charron, Girardot and de Knyff, all had exactly the same vehicle, Panhard racers of 27 h. p. The double cylinder vertical engine is placed in front, and the construction follows the same general lines as that of the ordinary Panhard vehicles. The cases are entirely of partinium, an aluminum alloy.* The engines are governed on the hit-and-miss principle, and when the vehicle stands still and the engine is runing, an explosion, occurring every three or four seconds, will set every sheet of partinium of the body vibrating, thus producing a strong metallic ring, which gradually dies out only to be reinforced by another explosion.

Mr. Winton employed the vehicle illustrated in THE HORSELESS AGE some time ago. It has a single cylinder engine, of his own type, of 6½-inch bore and 6¾-inch stroke. The weight of his vehicle with supplies is nearly 2,000 lbs.

Before covering 75 miles of the course Mr. Winton had a rear tire punctured and a front wheel damaged, which retarded him considerably. A little farther on, René de Knyff broke his high-speed gear, which put him "hors de combat." Girardot brok a wheel at Orleans in running against a walk, trying to evade a horse team. Charron bent his rear axle running against a mile stone; and Jenatzy also had an accident. Charron and Girardot finished, however, the former in 9 hrs. 9 m., and the latter in 10 hrs. 36m. The actual distance is 354 miles, giving a mean for the winner of nearly 39 miles an hour. This is more than the average made by the express train running between Paris and Lyon.

RACING MACHINE OF THE NESSELDORFER WAGENBAU-FABRIKS GESELLSCHAFT.

As is usual on such occasions a large number of dogs were sacrificed to the cause of science (or to the cause of sport). Jenatzy claims to have five or six on his conscience, and if the other contestants killed each as many this was certainly an unlucky day for the dogs of France. Many flocks of sheep were also encountered by the racers, and it is just short of a miracle that no serious accident happened to anyone of the participants.

In general it is the impression here that the race was very badly organized, that insufficient preparations had been made for it and that it must be looked upon as a failure.

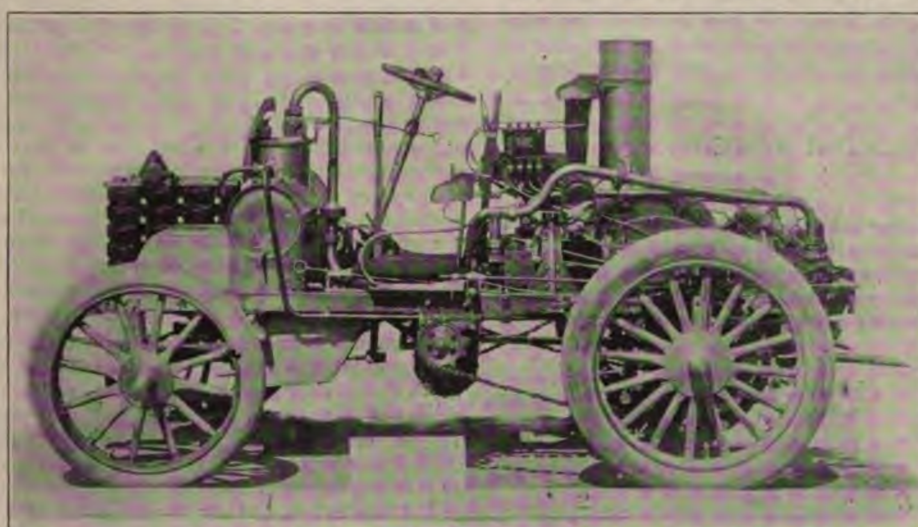
* See THE HORSELESS AGE, June 20.

## THE FIRST RACING AUTOMOBILE MANUFACTURED IN AUSTRIA.

The Nesselsdorfer Wagenbau-Fabriks-Gesellschaft in Austria, which for three years has manufactured automobiles, competed with their automobiles in France this year for the first time, and participated in the races at Nice. At the race of touring automobiles they received the second prize on the route Nice-Draguignan-Nice, and at the Turbie hill climbing contest the first prize. The automobile was especially adapted to the Austrian roads and had a gauge of 1150 mm., which is about 200 mm. less than the French carriages.

The speeds obtained with racing automobiles being already such as to preclude such a small gauge, the firm resolved to create a new automobile system qualified to use the greatest speeds obtained up to now.

This racing automobile (see the illustration) has no longer the aspect of a carriage but of a machine. It is double seated, the driver's seat being elevated and the seat of the machinist at the feet of the driver, in order to reduce the wind resistance as much as possible.



RACING MACHINE OF THE NESSELDORFER WAGENBAU-FABRIKS GESELLSCHAFT.

The steering wheel is mounted before the seats, and in front of this is the fuel tank. At the front of the machine is the radiator, exposed to the wind as much as possible. Behind the driver's seat is placed the water tank, in appearance resembling the stack of a locomotive.

The motor has two horizontal cylinders, one opposite the other; these cylinders have a diameter of 120mm. (4.8 in.), and a stroke of 110mm (4.4 in.). The maximum number of revolutions of the motor is 1300 a minute, which can be reduced to 100. The electro-magnetic ignition is variable. The motor is not inclosed, so that every part is easily accessible.

On horizontal good roads a speed of 92 kilometers an hour, and on gradients of 12 per cent. a speed of 25 kilometres an hour can be obtained. The pneumatic tire of the rear wheels have a diameter of 120mm., those of the front wheels of 90 mm. The weight of the complete automobile, including equipment, is 970 kilograms (21,340 lbs.)

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The Liverpool *Journal of Commerce* has decided to publish every alternate Tuesday, under the designation "Heavy Motor Traffic," a series of Notes dealing with the development of motors in different parts of the country, so as to keep its readers in touch with a movement which seems destined to do for the road what electricity promises to do for railway traffic—revolutionize it.

# ...COMMUNICATIONS...

## CONTROLLING THE SPEED.

DUNCAN FALLS, N. Y., June 21.

*Editor* HORSELESS AGE:

In motor carriages, in which the speed and power of the (four-cycle) engine are under the direct control of the operator, is it considered necessary to use a governor? If so, on what function of the motor does the governor act?

By what principle of action do the spark-timing devices modify the speed and power? S. M. H.

[Whether or not an automatic governor is applied, to keep the motor from attaining undue speed when disconnected or in the low gear, depends largely on the preference of the builder and his ability to meet the conditions. The governor is usually omitted from light carriages of moderate power, but is considered a necessary adjunct when the motor is powerful. In the latter case the result, if the motor "runs away" when suddenly disconnected, is more likely to be serious; while the operator usually has enough to do without looking after the speed of the motor. The practical problem is to produce a governor whose action will not be too much affected by the jolting of the vehicle. The governor, if one is applied, may act either on the hit-and-miss or on the throttling principle. In the former case it will usually either hold the exhaust valves open or close the gasoline supply, but it may hold the exhaust valves, or even the inlet valves, shut if preferred.

The effect of retarding the spark may be understood by remembering that the mixture of air and vapor burns most rapidly when it is most highly compressed, i. e., when the piston is near its inner dead point. The movement of the piston is also slowest at this time, and therefore a large proportion of the mixture is burned and has contributed to the pressure on the piston before the latter has advanced far on its outward stroke. If on the other hand the spark does not occur till the piston has begun to move out the combustion cannot spread rapidly enough to keep up with the piston's motion. The maximum pressure on the piston is therefore lower and much of the mixture is burnt too late to utilize the expansive effect

of the heated gases. Consequently the power developed per stroke is less than with the ignition timed for the best efficiency. It is a rather wasteful way of controlling speed, but it is convenient and does not disturb the functional performance of the vaporizer, as a throttling governor is apt to.—ED.]

## ANOTHER DAMAGE SUIT LOST AND WON.

ST. LOUIS, June 26.

*Editor* HORSELESS AGE:

Once more the owners of frightened horses have failed to get judgment in a suit at law against the owner of an automobile.

Herewith I inclose an item from St. Louis *Globe-Democrat*, of 24th inst., which explains itself. JOHN C. HIGDON.

The clipping reads as follows:

The damage suits against John C. Higdon, resulting from an accident in the county, in which his automobile was concerned, were dismissed in the Circuit Court at Clayton yesterday by the plaintiff at the cost of the defendant. Near the county seat a horse became frightened at the automobile and overturned a buggy containing Mrs. Katherine Onslen and her daughter, who was an invalid. The daughter died within a few days afterward, but the physicians claimed that her death had no connection with the accident. However, Mrs. Onslen brought suit to recover damages.

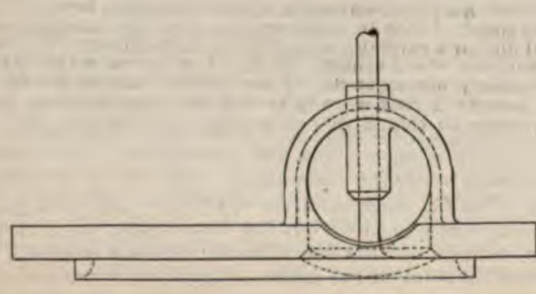
## A PACKING REMEDY.

AKRON, OHIO June 12.

*Editor* HORSELESS AGE:

Please accept thanks for the practical suggestion called out in answer to my questions published in THE HORSELESS AGE.

As I have succeeded in overcoming the packing difficulty it is no more than right that your readers should have the benefit of my experience in making my cylinder head. I screwed the exhaust pipe into a boss cast on it for the purpose. This boss came to the edge of the head as shown, and crowded the bolts at that space farther apart than they naturally would be. It also cut into the thickness of the plate, making it much thinner than it was originally intended. This made it so weak that it would spring with the pressure or warp with the heat (the head is not water jacketed). I made a new head, and in packing it put in two thicknesses of asbestos 1-32 inches thick, filling it with shellac and screwing the head down while still moist. Since then I have had no trouble.



"ONE OF THE CRANKS."

## BALANCING THE CONNECTING ROD.—LOCATION OF THE WRIST PIN.

ANDERSON, IND., June 24.

*Editor* HORSELESS AGE:

As the connecting rod is a hard member of an engine to balance in a motor carriage, will you show in your valuable paper the construction of a rod that is considered best on an engine 5x8 inches. On page 17 of our May 2 issue the De Dion-Bouton piston is shown with about one-third of its length turned smaller in diameter than the cylinder. Considering the fact that the outer end of piston is forced against the cylinder wall with great force in the work stroke, owing to the angularity of the connecting rod, is it not best to have all the surface on piston possible? I have frequent calls to rebore cylinders which show a cutting out of cylinder by front end of piston during the working stroke. I call to mind one 13-inch cylinder which was cut out three-sixteenths of an inch. Is not the proper place for wrist pin somewhere back of centre of piston nearer the ring end? Will you give the exact position?

Very truly yours, C. D. B.

[As good a design as any for the connecting rod of this size of engine is the common "marine" end, of which an example was shown in Edward S. Clark's steam engine in THE HORSELESS AGE of April 11, and also in his advertisement this week. The end of the rod has a T head forged on it, and the brasses are bolted to this, usually with a shallow tongue entering a groove in the steel, to keep them from slipping. The piston end of the rod is usually forged solid and bored for a solid bushing, which is renewed when worn. The main point as regards balancing is to keep the piston end as light as possible, as this can be only very imperfectly balanced in a single-cylinder engine, whereas the crank end can be balanced very well by means of weights bolted to the cranks.

We are not clear why the De Dion piston is reduced to the extent shown in the cut referred to. It is common practice to cut one or more circular oil grooves in the piston, as these help to distribute the cylinder oil and are found to aid also in packing the piston against leakage. The wrist pin is usually put a little below or in front of the rings. Theoretical considerations would put it nearer the front or open end of the piston, the idea being to bring the pressure where the lubrication is best; but in order to save space and weight of engine a compromise is usually made, and the pin is put somewhat back.—ED.]

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The first motocycle delivery service in this country has just been instituted in Hartford by the Columbia and Electric Vehicle Company, gasoline motor tricycle carriers being employed in the service. They are operated from a central station at 45 Wells street, where they are on call, together with passenger vehicles capable of carrying four people.

The packages are brought from the stores to the central station, where they are sorted according to the districts in which they are to be delivered. By a system of collecting packages on a number of routes each day the service is made available to those who have a comparatively small number of deliveries to make. The vehicles may also be rented for stated periods.

# ...OUR... FOREIGN EXCHANGES

## THE NEW MORS RACING CAR.

The accompanying photograph of M. Levegh's new Mors racing car is of special interest, as it depicts not only the first of the new series of *voitures de course* which has issued this season from the Grenelle factory, but it also illustrates what is assuredly the fastest French gasoline car now on the road. Generally speaking, one does not expect to see the new types of French racing cars before May, but this year Mors have been very energetic, and the first of their new stud was finished in time for the Nice week, which took place at the end of April. Its initial performance was not a conspicuous success, for in the Nice-Marseilles race the mounts of Rene de Knyff, Hourgières, Charron, and Pinson all finished ahead of the Mors champion, which, however, had had the worst of luck in the matter of tire troubles. That this form was too bad to be true was conclusively proved four days later, when in the Nice-La Turbie race M. Levegh steered his car over the seventeen kilometre of hill, most of it with a 10 per cent. gradient, in 19 min. 2 sec., no less than 17 sec. faster than the time made by any other competitor, and 6 sec. faster than M. Lemaître's record. The following day this victory was confirmed by M. Levegh's performances in the time trial he made over a kilometre and a mile, the former distance being taken from a flying start. In both he was accorded a walk over, as none of the other big cars competed. His times were—one kilometre from a flying start, 48¼ sec.; one mile from stationary start, 1 min. 32¼ sec. The only other occasion on which the vehicle has had opportunity of showing its capabilities was the hill-climbing contest at Cannes, known as "L'Esterel," and here again it came in first of the cars. The time made for the 13 kilometres 600 metres was 14 min. 44 sec., an altogether exceptional performance when the severity of the grade and the sharp turnings of the course are considered. And what is the horse power of the motor? one naturally asks. Well, I would just like, first of all, to point out a great change that has come over automobile constructors in the matter of quoting horse powers. One or two years ago makers and owners alike exaggerated the actual power of their motors in about the same proportion as they now diminish it, and the reason for the change is this: Frenchmen became educated in the question of horse power and received with an incredulous smile the constructor's assurance that the motor was of such and such a force. Accordingly the maker went on the other tack, and to-day he says, "See how my 12 h. p. motor beats those of 16 h. p. made by other firms." It is very confusing and misleading, but under existing circumstances what can be done? If a man likes to call his motor, which develops 30 h. p. on the brake, a 10 h. p engine, what is to prevent him? The car illustrated is known at the Grenelle factory as the "1900 type," and this is, perhaps, the fairest way of designating a racing car. I have every reason to believe that the motor develops 31 to 32 h. p. on the brake. The car itself is entirely similar in appearance to the last year's type of Mors racer, and gives one the impression of being a veritable "flyer." The owner and driver is M. Velghe, a well known member of the Automobile Club of France, who races under the name of Levegh, and who is undoubtedly one of the very few automobilists capable of driving such a car for all she is worth. It is probable that in addition to MM. Levegh and Antony, both of whom have achieved so many suc esses on Mors cars, Maurice Farman will this year be seen racing with a similarly powered vehicle of Grenelle construction.—*The Motor-Car Journal.*

## HOW ABOUT THE BUSINESS END?

Where is speed leading the trade to? Certainly not in prosperous paths. Of what commercial value can a car be that has been driven by some wealthy person at an enormous and dangerous pace? There is an absolute absence of any special endeavor to cater for business cars, the whole idea being to get excessive speed. I look in vain for any motor firm making, say, a special doctor's carriage, or a tradesman's delivery van, or a commercial traveler's vehicle. Motor dust carts, water carts, etc., are simply non-existent. These motor vehicles would be readily bought if they were to be had, but they are not. The cry in answer to this is, of course, that the demand even for motors as pleasure vehicles exceeds the supply, but there are several companies which could have supplied more vehicles could they have been certain of sales; in fact, there is plenty of motors of different manufacturers waiting for purchasers now. If motors are to be looked upon in the same way as bicycles used to be—entirely as a luxury—it will take a good many years to pronounce the much-talked-of doom of the horse.—*London Morning Leader.*

## THE ROCHET VOITURE.

Figure 1 shows the frame and running gear of this vehicle, which are so arranged that a variety of bodies may be mounted on them and secured thereto by bolts. Fig. 2 shows the "duc tonneau" style of body, but any other may readily and quickly be susbtituted for it.

The vehicle is steered by a handle-bar T, of which the left handle in best upward while the right hand one is horizontal. The handle bar method of steering is credited with numerous advantages over the wheel; its management is more instinctive, its position indicates at once the angle of the front wheels, a thing impossible with the hand wheel and yet of the first importance when manœuvering in close quarters.

At the driver's right is a brake lever W, which tightens leather lined brake bands on two drums, one on each of the rear wheels, after first having by the same movement disengaged the motor at the cone clutch V. This lever W is latched by a dog engaging a notched segment, so that the vehicle may be braked and the hand then employed for other purposes.

Another and larger lever U acts on the speed-changing gears, To increase the speed, the lever is moved forward, while a backward movement engages the lower gears successively and then reverses the vehicle. There are four speeds forward and one reverse.

There are two pedals, of which the left hand one first disengages the motor and by further movement applies a brake on the differential. The right-hand pedal acts in precisely the same manner as the lever W, first disengaging the motor and then applying the rear wheel brakes. These brakes can therefore be applied either by hand or by foot, as most convenient. In an emergency both brakes can be applied at once.

A third pedal, operated by the driver's heel, releases a latch governing the speed changes, and is always operated in connection with the lever U.

On the standard of the steering handle are two small handles working on notched segments. One of these acts on the governor of the motor and the other on the ignition, to vary the lead of the latter.

Finally, a ring, which is normally caught on a hook, just below the cushion and at the right, holds up a ratchet pawl and a prop designed to stop the vehicle from running backward down a slope. Thus, if by any mischance the power fails when ascending a hill, a quick movement unhooks the ring and the pawl engages and locks a ratchet on the differential, while the lower end of the prop falls and thrusts against the ground.

Turning again to the running gear a plan and an inverted plan of this are shown in Figs. 3 and 4. The frame is constructed from cold-drawn steel tubing with brazed joints, and is very rigid. All of its members are in internal communica

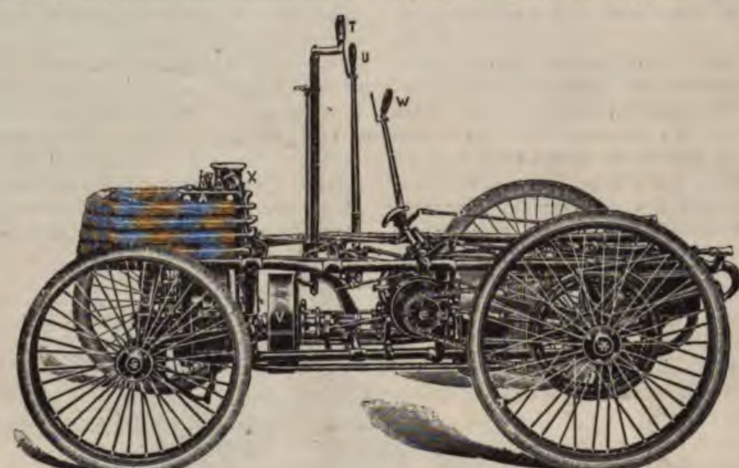



FIG. 1.

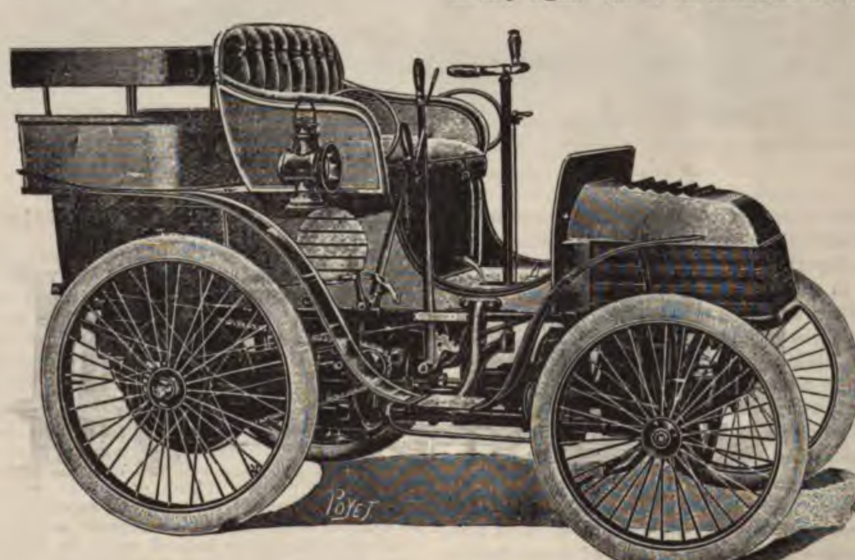


FIG. 2.

tion, and it is made to serve as an auxiliary cooler for the jacket water. Two semi-elliptic springs in the rear and a transverse elliptic spring in front support the frame on the axles.

The motor is in front and the power is transmitted through the conical friction clutch V $V^1$ and the shaft P to the speed-changing gears in the case F. From this the differential shaft is driven through the medium of bevel pinions at G.

The Rochet motor is an adaptation of the Daimler motor, but it embodies a considerable number of improvements in the details of its construction. It is shown in Figs. 5 and 6, and has two cylinders, developing 6 or 8 h. p., according to size. Some vehicles have two of these motors on one shaft, which gives them 12 or 16 h. p. The two cylinders are cast in one piece and bolted to the crank case. All the moving parts, save the last levers acting on the exhaust valves, are inclosed. The crank case has the usual splash lubrication, and a glass set in its side enables the operator to observe the level of the oil. The governor is within the drum J, and the starting crank is worked from the front end of the vehicle. The cover B incloses a commutator to distribute the current for the spark, first to one and then to the other cylinder.

The valve box is cast in one piece with the head. The fresh mixture enters at T and passes to one or the other cylinder, while the exhaust gases pass out at Z Z. On top of the valve box are four screwed plugs, a a c c, which permit immediate access to the valves without dismounting the cylinder head; a highly meritorious feature, as everyone can testify who has gone through the nuisance of uncoupling the exhaust and supply pipes in order to regrind a valve on the road. The two plugs c c over the inlet valves are formed to receive the sparking plugs K K.

Two cups M M on the cylinder head are provided for the introduction of a few drops of gasoline, when starting, to dissolve any gummy oil that may have clogged the piston rings.

The governor is set to permit a normal speed of 800 revolutions per minute. The cranks are set opposite to minimize vibration. The speed of the motor is controlled by causing one or both of the exhaust cam rollers to run off from thin cams on to adjacent circular cams, thereby putting one or both of the exhaust valves out of action.

The air supply to the vaporizer is warmed by passing around the exhaust pipe, and the mixture is diluted by an adjustable opening on its way to the motor. A small screwed plug at the base of the vaporizer permits of draining the latter of stale gasoline, and also of lowering the gasoline level in case the vaporizer becomes "flooded" by non-operation of the float.

*—Adapted from La France Automobile.*

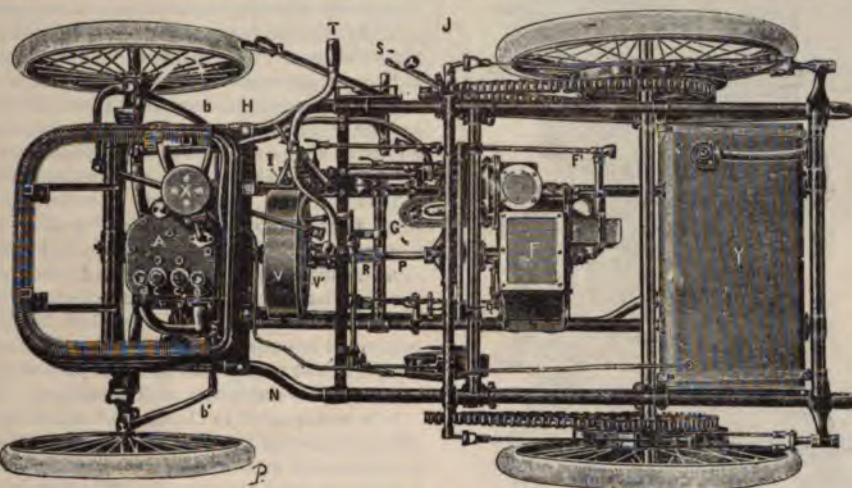



FIG. 3.

The Decauville Company, the manufacturers of the well-known Decauville voiturette, are said to have last year exported 87 vehicles of various descriptions, two going as far away as the Dutch East Indies, one to Egypt, one to Greece and one to Manchuria.

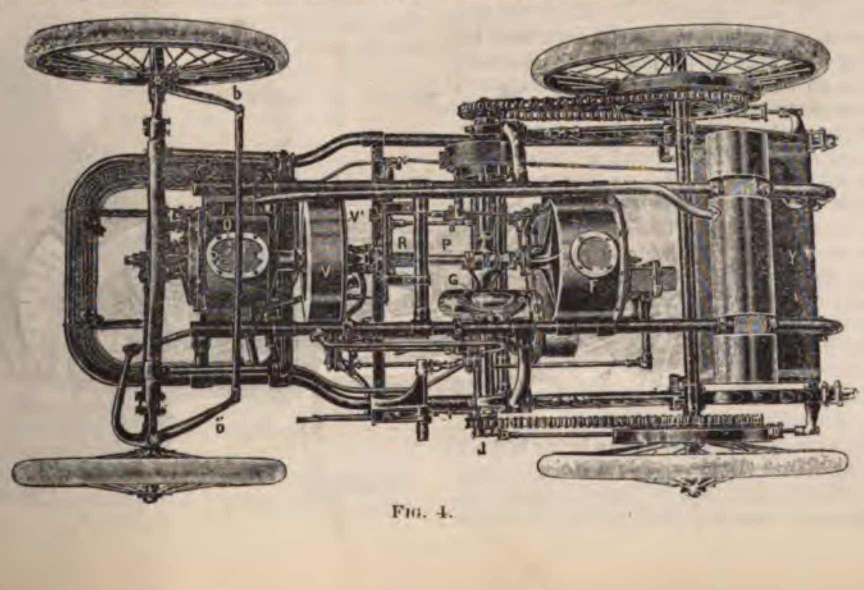



FIG. 4.

## THE BRITISH LAW IN MOTOR-CAR ACCIDENTS.

BY T. W. STAPLEE FIRTH.

Law prescribes a certain minimum of mental alacrity to be exhibited by all persons in the community under various circumstances. Such a prescription is absolutely needed to secure the common advantages of civil intercourse, otherwise every one's health and personal security would be at the mercy of every other person who might choose to indulge in thoughtless and reckless conduct. Thus, in every condition and situation of life law exacts that every normal subject of the State shall carefully watch that his acts or omissions do not interfere with the enjoyment of rights which are vested in others.

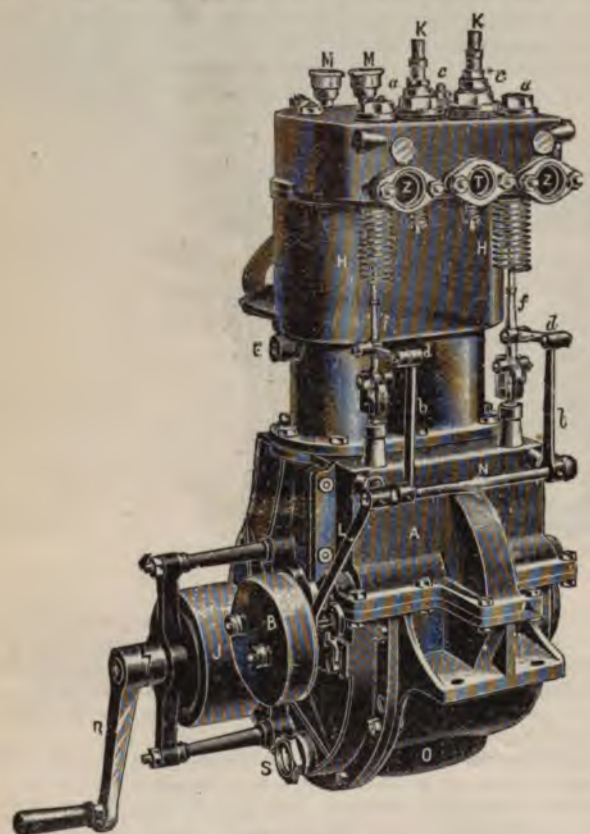



FIG. 5.

The amount of watchfulness needed will be determined by each particular case, and will vary in proportion to the risk, and in inverse proportion to the knowledge and appreciation of the person to whom the duty is owed. The absence of this variable amount of care is negligence. In all actions for damages negligence is the root and foundation, and without direct proof of negligence an action for damages cannot be maintained. The definition of "negligence" as laid down by the law is therefore important, and this definition can best be given by quoting two which are adopted by the courts. The first judicial definition is by Baron Alderson, who describes it as "the omission to do something which a reasonable man, guided by those considerations which ordinarily regulate the conduct of human affairs, would do, or doing something which a reasonable and prudent man would not do."

And, again, by Justice Holmes, in an American case: "If a man's conduct is such as would be reckless in a man of ordinary prudence, it is reckless in him. Unless he can bring himself within some broadly-defined exception to general rules, the law deliberately leaves his personal equation or idiosyncrasies out of account, and peremptorily assumes that he has as much capacity to judge and foresee consequences as a man of ordinary prudence would have in the same condition." There must, however, be added to these definitions a proviso that the party whose conduct is in question is already in a situation that brings him under the duty of taking care.

Negligence, then, in its proper legal acceptation, describes an outward and visible action. From an analysis of negligence then, we arrive at the following propositions:

(1) It is the omission to fulfil a duty toward a determinated person or persons imposed by the law.

(2) The standard of duty is the foresight and caution of a prudent man.

(3) The duty is not absolute, but relative; "it is always relative to some circumstances of time, place or person."

(4) The negligence, to be actionable, must have been the proximate cause of the injury.

Having thus premised on negligence generally it is necessary to point out at once that to found an action for damages to a motor car the aggrieved person must prove affirmatively that such action arose from the negligence of the party who caused the damages. There seems to be a very common notion among a large proportion of the public that if, for instance, a horse bolts and an accident ensues in consequence of a motor car, the owner of the motor car is responsible, and it is quite sufficient to prove the bare fact that the presence of the motor car caused the accident to happen to obtain damages.

This is clearly not so, and to recover damages for any accident that happens, the nature and extent of the injury are immaterial, the person claiming must prove, not that the accident happened in consequence of the motor car, but that the accident happened in consequence of faulty construction, under Section 13 of the Locomotive Act, 1861, or that the accident happened in consequence of some direct act of negligence of the owner of the motor car, or some person in his employ, and acting under his authority and direction.

It is well settled in the case of Hammack vs. White that the onus of proving affirmative evidence of negligence to maintain an action for damages rests with the plaintiff, and it was also held in the case of Cotton vs. Wood that to support an action for negligence the plaintiff must give proof of well-defined negligence in order to warrant the judge in leaving the case to the jury, and unless he is satisfied that there is clear evidence of negligence it is his duty to stop the case.

His Honor, Sir Alfred Marten, has tried several motor-car cases, and has laid down very sound law on the general subject, and in one of his judgments he went so far as to direct the jury that "every horse ought to be properly trained for the

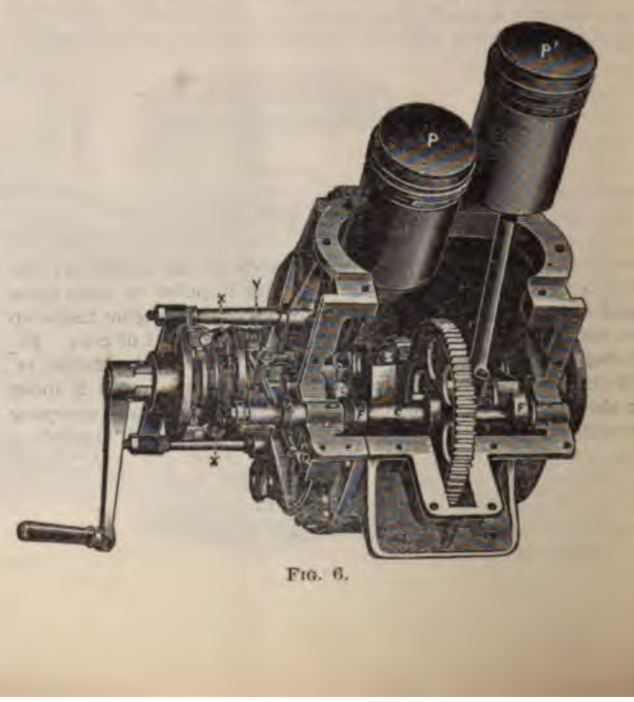



FIG. 6.

road." Precisely the same principles of law apply to a motor car as were laid down in the case of Hammack vs. White, where it was held by Chief Justice Earle and Justices Williams and Willes that the mere happening of an accident is not sufficient evidence of negligence in an action for damages to be left to a jury, but the plaintiff must give some affirmative evidence o negligence on the part of the defendant. In the case mentioned the defendant was riding a horse at a walk when the animal became restive, and rushed on to the pavement and knocked down and killed the husband of the plaintiff, but the witnesses for the plaintiff also proved that the defendant was doing his best to prevent the accident. It was therefore held, as there was no evidence of negligence, the defendant could not be held responsible for the consequences of the accident, and therefore the action for damages failed.

A similar doctrine was laid down in the case of Redhead vs. Midland Railway Company, where, in consequence of an accident, plaintiff was severely injured. When the case was tried the plaintiff relied upon the fact of his injured condition, and that he received such injuries while traveling in the company's train as sufficient to establish his case, but it was held there that as no direct act of negligence was proved against the company he had no remedy at law. There are, of course, many other decided cases of this nature, and in case of damage to a motor car, or caused by a motor car, if the owner is sued for damages it should be remembered that neglience is the essence of the whole case.

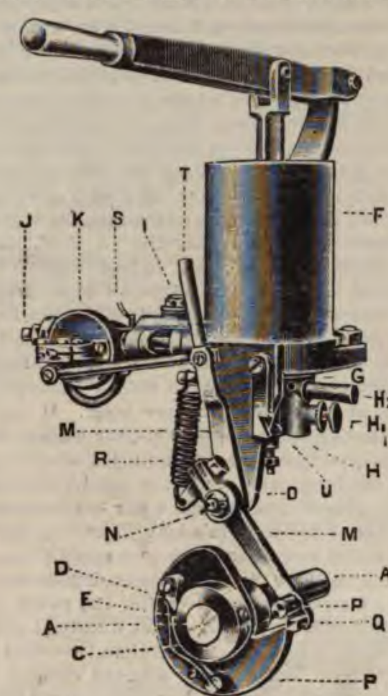
In a case at Sittingbourne, where three horses bolted, and one, a valuable shire horse, dashed through a large plate-glass window, causing its own death and a good deal of damage to property, in consequence of the approach of a motor car, an action to recover damages for the horse failed because the plaintiff did not give affirmative proof of negligence by the driver or owner of the motor car, although it was admitted that the horse bolted, and the accident happened in consequence of the presence of the motor car.

It may be usefully added, as a hint to automobilists, that in the event of an accident happening they should as soon as possible get the names and addresses of persons who witnessed the accident, if any.—*The Automotor Journal.*

## SELF-STARTER FOR GAS ENGINES.

The rapid development of gas engines of large power, which has taken place during recent years, has rendered necessary the adoption of some self-starting device. The method of starting by turning the flywheel round by hand—which has frequently necessitated the help of some four or five men, and in many cases resulted in personal injury—has, it will be generally acknowledged, been a serious drawback to the development of the large-sized motor. This objection, however, has been overcome in a practical manner by the introduction of Edmondson & Dawson's patent starter, shown in the accompanying illustration, and manufactured by Joseph Edmondson, of Albert Works, Key street, Bradford. The starter, which can be applied to any type of gas engine from 4 h. p., is of the type in which more or less compression of the charge is effected by a pump worked by hand. It gives an initial impulse automatically proportioned to the requirements of the engine at the time, and follows this up by a further impulse at each cycle until the ordinary ignition apparatus of the engine takes up the running, when the starter may be thrown out of gear. Referring to the illustration, A is the cam shaft of the engine, revolving clockwise; B is the cam of the starter, which is loose on the shaft; C is a collar, fast on the cam shaft, and carrying forward (clockwise) the cam B by means of the click D fixed on the cam and dropping into the notch E on the collar. This leaves the cam free when the engine runs backward; F is the pump; G is the valve box of the pump, having an aperture H coupled to the gas supply, a regulating screw $H^1$ for gas, and a second aperture $H^2$ for admitting air I is the check valve, and K the ignition valve, having an orifice J on the left, to be connected by a tube with the interior of the cylinder of the engine; L is a link connecting the arm on the plug of the ignition valve with the adjustable lever MM, moving on the stud N on the bracket O; S is the pilot flame, lighting an ignition jet in the ignition valve K; and U a catch to hold lever M out of gear.

The action is as follows: The engine being set on the "explosion stroke," with the gas cock turned on, and with the




crank a little behind the top centre, the starting cam B having the square stud Q resting on its nose, a few strokes of gas are pumped into the cylinder by the pump F. The pumping being continued with gas and air (forming an explosive mixture), the charge is slightly compressed till it propels the piston slowly, and moves the cam B forward (clockwise), drops the roller P into the gap of the cam, and releases the lever M. The spring R then rotates the plug of the ignition valve toward the right, ignites the charge in the cylinder and propels the engine. If the pumping be still continued gently (one stroke for each cycle), so as to keep the connections between the pump and the cylinder full of explosive mixture, the revolution of the cam B, by opening and closing the ignition valve, and exploding the charge at the proper times, will give successive impulses to the piston, increasing its speed until the ordinary igniting apparatus takes up the firing, and the engine is effectually started. The starter is then thrown out of gear by pushing the handle T of the lever M to the left, when the catch U falls down and holds the lever, so that the roller P stands free of the cam B, and the action of the starter ceases.—*The Mechanical Engineer.*

## ANOTHER CUP RACE POSSIBLE.

Paul Meyan, in the *Figaro*, says that there may be another race this year for the international automobile cup.

A repetition of the contest within the current year being contrary to the rules, the stewards, who are desirous of a second race, have forestalled any protest that may be made on this score, thus rendering it possible for another challenge to be made for 1900. M. Meyan conjectures that some foreign club intends recommencing the struggle, and hopes that a suitable French team will be selected.

## MORE ABOUT THE RACE.

The correspondent of *The Motor-Car Journal*, describing the Gordon Bennett Cup Race, writes in part as follows:

Away out into the country I tramped (from Orleans), and had reached and rested a good 40 minutes at the tiny halmet of Le Moulin Choix before away in the distance was heard the Maxim-like sound of a big racing machine. I looked at my watch, which showed 5:7, and inwardly remarked, "By Jove, they are traveling in spite of all the local regulations," for to cover some 163 kilometres in 2 hrs. 7 min. means fast going. The noise continued for perhaps a minute, then ceased as the car ran behind an intervening hill, only to break forth with redoubled vigor as the racer's nose showed above the crest of the hill and dashed down towards us. The local enthusiasts sent up a howl of despair. The car was red! America's color! But as she whizzed past us I recognized the grim countenance of M. Levegh, and was able to reassure the group of villagers that it was no American invader who was leading the way, but merely a French automobilist whose car the "A. C. F." had not considered good enough to represent "la belle France." As Levegh was traveling at some 90 kilometres an hour the effect of my explanation was that the good people of Le Moulin Choix fully anticipated seeing the actual representatives of their fatherland fly rather than drive past, and when 35 minutes later M. Girardot hove in sight they were visibly disappointed at his moderate gait of about 56 miles per hour. It was near to Le Grand Orme that Girardot passed us, for we had walked back a couple of kilometres, and five minutes after he had disappeared down the long, level stretch of road, Charron arrived at express speed. Never have I seen a car travel so fast on level ground as did that of Charron's last Thursday morning at Le Grand Orme, and I have seen some few races too. She simply flew along, and then at St. Jean de la Ruelle she struck the caniveau (block pavement) traversing the route close to the Mairie, and was pulled up with a back axle bent almost double and a pump badly wrecked. By the time I reached the scene of the mishap Charron had roughly effected repairs and set out again, but very slowly, and no one anticipated that he would finish the race. We then procured and hoisted a green flag some 30 yards before the caniveau, and this, aided by plenty of shouting, had the effect of reducing De Knyff's speed to walking pace ere he reached the dangerous spot. A wave of the hand from De Knyff, and off he went again, but not at the pace at which he usually races, and it was obvious from that and the grinding sound made by his car that something was amiss. Jenatzy was the next comer, and he also was not traveling well, while the car of Mr. Winton, the whipper-in, presented a woe-begone appearance, with a buckled front wheel and a collapsed tire. A long tramp brought me back to Orleans, where I heard of Girardot's accident as he was leaving the town by the Porte de Bourgogne. A frightened horse, a sudden swerve, and the back wheel broken against a curbstone, such briefly the story of Girardot's mishaps. This resulted in a loss of some 80 minutes to him, but for which he would doubtless have made a desperately close finish with Charron. It was here, too, that Mr. Winton decided to abandon the contest, and it is quite possible that had not the Comte de Chasseloup-Laubat been at Orleans and told Charron how matters stood, he, too, would have discontinued. The official returns at this point, 173 kilometres from the start, were as follows:

| Name. | Time. | Average. |
|---|---|---|
| 1. Girardot | 5:53 | 60.0 kilometres |
| 2. Charron | 6:10 | 58.9 " |
| 3. De Knyff | 6:49 | 48.2 " |
| 4. Jenatzy | 6:52 | 47.6 " |
| 5. Winton | 8:30 | — |

Between Orleans and Glen there are 63 kilometres, and at the latter place Charron arrived at 7:15 a. m., followed by Jenatzy at 8:25 a. m., and Girardot at 8:45 a. m., their respective average speeds per hour being 58.70, 45.00 and 42.70 kilometres. Here de Knyff, who had, previous to reaching Orleans, decided to abandon the race, actually quitted the route and returned to Paris with MM. Krebs and Chasseloup-Laubat. At Nevers, 322 kilometres from the start, Charron was a long way ahead of Girardot, and his average speed per hour was 59.69 kilometres as compared with the latter's 47. Jenatzy had dropped into the last place of the three remaining competitors —tire, gear and ignition troubles worrying him incessantly. Fifty-four kilometres further on, at Moulins, Charron found Huillier and Levegh awaiting him, and they lent a willing hand in refilling his petrol tanks. At that point the ultimate winner's average speed had advanced to 60 kilometres per hour. Girardot arrived an hour and a half later, and after rapidly replenishing his petrol tanks he also made haste for Lyons. As for Jenatzy, he was hopelessly en panne some few kilometres outside the town. At La Palisse Charron passed through the town at 10:9 a. m., and Girardot at 11:44, while at Roanne, 49 kilometres further on (476 kilometres from the start), the former arrived at 10:56 a. m. and the latter at 12:34. From La Palisse onward the route became very hilly, with numerous nasty turnings, until the last 12 or 15 kilometres into Lyons had to be negotiated, where the road was excellent. It was here that Charron met with an extraordinary accident. When traveling at nearly 100 kilometres an hour a large dog ran right in the way of the car and became wedged between the steering gear and the springs. The vehicle swerved violently to the left, passed between two of the trees bordering the route, descended into the ditch, mounted again, and continued its course down the road. And the dog was dead! And so was the pump pretty nearly; for Fournier, who was with Charron, had to hold it in place for the remainder of the journey.

From 10 o'clock in the morning a crowd of automobile enthusiasts had congregated before the hospitable doors of the "Delices de la Demi-Lune," that restaurant situated on the Arbrecle route, and so well known to all the chauffeurs and cyclists of Lyons. The members of the local automobile club had turned out in great force, and they were supported by many well-known motor men from all parts of France. Had the melancholy finish of the race been anticipated, I doubt whether the attendance would have been so large, for while recognizing the superiority of the French cars, still a semblance of a struggle was expected. But not a bit of it. The race was but a race in name, and not a particle of excitement could be worked up over the arrival of but two competitors, and these two representing the same country, and separated by the trifle of an hour and a half. Charron reached the controle at 12:23 in a considerably exhausted condition, while his *mecanicien*, Fournier, was even more done up, having been required to hold in place a damaged pump during the last 12 kilometres of the course. Girardot arrived at 2 o'clock, and after that, although anxiously awaited, no other competitor put in an appearance. What a tame conclusion to what promised to be a terrific race! But there it is; and we must wait a twelvemonth ere we again have an opportunity of seeing a contest for the Gordon Bennett Cup. Will France again retain it so easily? Time will show.

## MILITARY TRACTION ENGINES IN CAPE TOWN.

One of the most interesting features of the Queen's birthday celebration in Cape Town was the procession of traction engines, each engine drawing a gun of the heavy siege train that is destined to bombard Pretoria if the Boer army elects to defend that town. These engines, which are very powerful, were manufactured in England. The guns are of the large 9-inch type.

The imperial military authorities use steam transport altogether in Cape Colony. Each engine draws five or six specially constructed wide tired vans of enormous size. In the daily work of the city, also, the horse has to a great extent given place to steam trucks, and on the streets leading to the docks, in the vicinity of the warehouses and mills, the puffing of the engine is heard all day long.

# MINOR MENTION

Terre Haute, Ind., will fall into line this year with a motor carriage race of the Fourth.

The Automobile Club of America is now talking of a run to Boston, to be held some time in October.

The Altha Automobile and Power Company, of New York, capital $500,000, has been incorporated in Delaware.

Milwaukee, Wis., will add an automobile parade to its carnival attractions. It is said that not less than 30 machines will take part.

The Kensington Automobile Manufacturing Co., of Buffalo, has filed articles of incorporation at Albany. Capital stock, $600,000.

"Tod" Sloan, the jockey, has purchased the racing machine of F. Charron, which took part in the Nice-Bordeaux contest. The price is said to have been 55,000 francs.

L. J. Landgon, of Buffalo, recently made a mile in 2:03 on a banked track in that city on his locomobile. The quarters were made in 33, 32, 32, and 26 seconds respectively.

It is proposed to supplant the line of carriages running between San Juan and Ponce, Porto Rico, by gasoline motor carriages, and a company has been organized in San Juan for that purpose.

M. Charron, the winner of the Gordon Bennett Cup Race, is quoted in favor of a much shorter course for future races, on the ground that it is impossible to race at the high speeds now attained without risking one's life.

A company has just been formed in Brussels with a capital of $200,000, to be known as La Société des Diligences, Courriers et Messageries Automobiles, and organize public services of motor vehicles in France and elsewhere.

The purpose of the recent increase in the capital stock of the Electric Vehicle Co., from $12,000,000 to $18,000,000 is to acquire all the stocks of the Columbia and Electric Vehicle Co., and of the New Haven Carriage Co., which has been owned by the former company.

The Eastern Yacht Club, whose clubhouse is at Marblehead Neck, Mass., has fitted up a shed for automobiles belonging to members. Facilities for charging are provided, and extensions will be added when necessary. At present about ten or twelve members own motor carriages.

Boston has two self-propelled fire engines, Hartford one, New Orleans one and Pittsburg has ordered one. It is estimated that the cost of keeping the constant steam pressure of 90 pounds in the auxiliary boiler of the automobile is about the same as the cost of keeping three horses in the stalls.

The General Power Co., 100 William street, N. Y., has sent us a pamphlet describing the Secor kerosene oil engine. This engine differs from most kerosene engines in that the oil is sprayed in liquid form into the air supply, somewhat as gasoline is. Combustion is said to be perfect, with no tarry deposits on the cylinder walls or head.

It is reported that Pueblo, Colorado, will shortly have a public automobile line in operation. Some time ago the idea of a trolley car line was agitated, but no line was built, and now it is said that motor vehicles will be put in service instead. These will have the advantage that they can be rented out to excursion parties also, and this, it is said, will be done.

In a few weeks the Pennsylvania Electric Company expects to receive some gasoline runabouts from the Hartford factory. A new charging station is being established at Woodside Park to facilitate the service in Fairmount Park and the Country Club section. In service the company has at the present time 30 vehicles.

A. L. Adams, a manufacturer of cycle and automobile lubricants, with headquarters in Webster, Mass., is using a motocycle bought of the Waltham Mfg. Co., in his New England business traveling. In a little over five weeks he has ridden it over 1,800 miles, and he reports that the fuel cost is from one-quarter to one-third cent a mile.

Arrangements are said to be on foot for the establishment of an automobile factory in Ottawa, Ont. A number of gentlemen from Toronto, interested in the enterprise, have been in the Canadian capital looking over the ground. The establishment will be the Canadian branch of an American firm engaged in the manufacture of these vehicles.

The Metallic Rubber Fire Co., 210 Centre street, New York, is making an inner tube tire whose cover is studded on the tread surface with flat headed rivets, driven from the inside and clinched on the outside, the heads nearly covering the inner surface. They claim for this tire that it will not slip on wet asphalt, is nearly puncture proof, and will outwear the ordinary kind.

E. L. Strong, president of the Cleveland Automobile Club; Walter Root and C. S. Ingalls, also members of the club, with guests, have started on a Canadian tour in motor carriages. Going by boat to Buffalo, they will thence cross to Canada, at Niagara, and will visit Hamilton, London, Sarnia and Port Huron, returning to American soil at Detroit, whence they will return to Cleveland by boat.

Professor V. L. Emerson, of Ottawa, Ont., is said to be at work on what he claims will be the fastest and most powerful automobile ever constructed. The machine will be operated by a hydrocarbon motor, which, it is expected, will develop between 30 and 40 h. p. The weight of the automobile, when finished, it is estimated, will be 1,100 pounds. The pressure at the point of explosion will be 380 pounds, and the gearing will be designed for a speed of 30 miles an hour. If necessary Mr. Emerson claims that he can run the machine fully 60 miles an hour.

T. E. Outhwaite, an Edinburgh automobilist, is planning a run from Edinburgh to London, 400 miles, without a stop, and if possible within 24 hours. He will use a 6 h. p. two-seated Daimler car, which will be provided with large tanks to carry 30 gallons of gasoline. A double set of radiators will also be fitted, and electric ignition may be added. A further project of Mr. Outhwaites' is to drive a tricycle from Edinburgh to London inside the 20 hours' record of J. W. Stocks. The machine to be used is a French-made De Dion, with a 2¾ h. p. engine, but no special fitments of any kind. Given ordinary luck Mr. Outhwaite is confident of bringing both performances to a successful issue. The car has already run 1,200 miles without giving trouble of any kind.

Governor General Chandle, of French West Africa, recently had occasion to visit the Valley of the Niger in order to reorganize the local militia which was in great disorder.

On January 22 he set out from Kati, a little town on the Niger, which is to be the terminus of the projected railway, in an automobile. He traveled only six hours a day and on the 24th reached Kita, 180 kilometres, or 112 miles from his starting point, having made an average speed of 15 kilometres, or more than nine miles per hour.

In three days more he reached the present end of the railway and thence proceeded by train to Kayes.

In five days he made a journey which would have occupied 13 or 14, if it had been made by ordinary Soudan conveyance.

## SOME MODERN STEEL WORK.

As an evidence of progress in Western engineering it may be noted that the City Engineer of Chicago recently placed with the Bethlehem Steel Co. an order for a hollow forged shaft to replace a breakdown in the North Side pumping station at that city. The new shaft, which measured 13 ft. 8½ in. in length and 19 in. in diameter, and weighed close to 10,000 lbs., was booked on May 30, and, under special emergency instructions was hollow forged, annealed and rough machined in time to go forward June 9.

Many of the power stations in Chicago and other Western cities are equipped with shafts of this description, but this is the first time a hollow forging has been specified for water works engines in that section of the country. The remarkably short time required by the Bethlehem plant for the production of such a shaft is worthy of note, but the manufacturers claim that their complete facilities enable them to meet just such emergencies, in addition to the large volume of general business which constitutes their regular output.

Among other work which the Bethlehem Co. has in hand is an 18-inch gun, to be used in firing the Gathman torpedo. This gun, which is being built for the War Department, is now nearing completion.

It will weigh, without its carriage, 59.6 tons, and will be proved by firing 10 rounds of solid shot, each weighing 2,000 lbs. and each requiring 450 lbs. of powder to secure the necessary velocity.

This test will be extremely interesting, and will take place some time in July at the Bethlehem Company's proving grounds, which are located at Redington, Pa.

The Bethlehem Co. has the contract for the entire equipment of steel shafts and engine forgings which are to go into the new steamer building by Harlan & Hollingsworth Co., at Wilmington, for the Mallory Line. These forgings are to be made of a high grade of open hearth steel, forged under hydraulic pressure and carefully annealed in accordance with the standard practice of their makers. They are making also all the shafts and forgings for the 11,000-ton steamer which is to be built by the Union Iron Works of San Francisco for the American-Hawaiian S. S. Co. In this instance the owners saw fit to recognize the character of the Bethlehem work by specifying that all the parts mentioned should be made at their plant, a most gratifying testimony to the good effect of the campaign which they have been carrying on in favor of a higher standard of material and workmanship in such important features of marine construction.

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Our esteemed contemporary, *La France Automobile*, has appeared in a new dress, and is now printed on better paper and with greatly improved typography and illustrative matter.

# MOTOR VEHICLE PATENTS ∴ ∴ OF THE WORLD ∴ ∴

## UNITED STATES PATENTS.

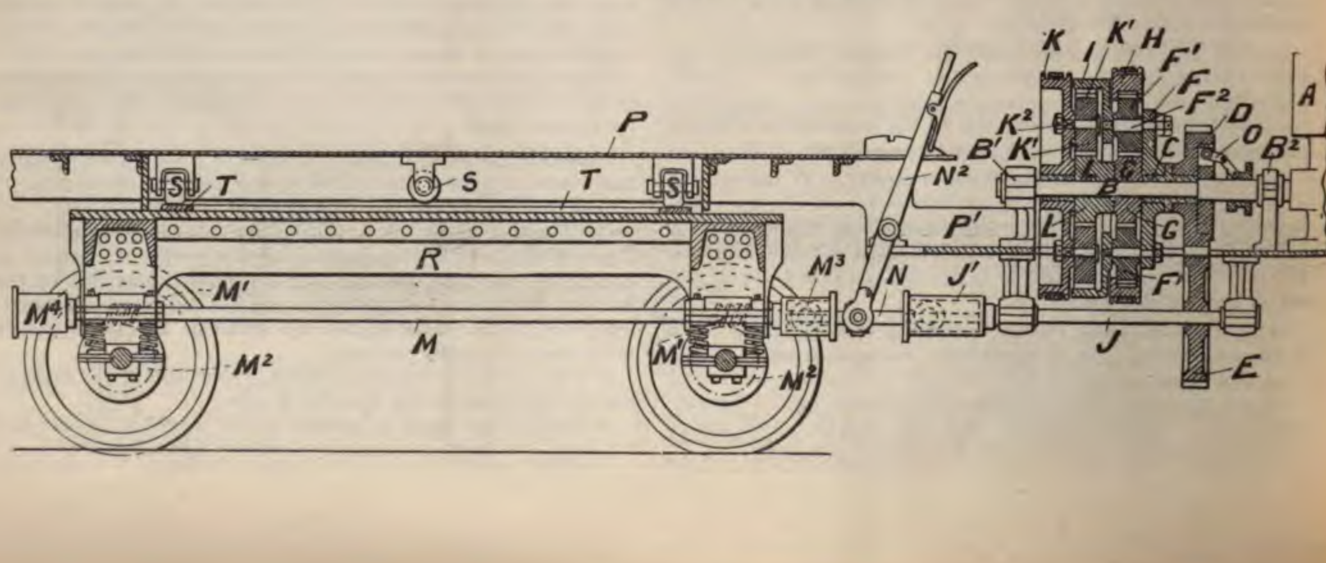
651,573—Power-Propelled Vehicle.—F. W. Lanchester, of Birmingham, Eng., June 12, 1900. Application filed Sept. 6, 1899.

This invention consists of two parts: First, a form of transmission gear by which two forward speeds and a slow-speed reverse may be obtained, and, second, an arrangement of truck and shaft-coupling by which the body of a tram car, carrying with it the motor (which is supposed to be of the internal combustion type and therefore irreversible), may be swiveled around upon the truck at the end of a route, so as to reverse its direction.

In the figure B is an extension of the motor shaft, running in bearings $B^1$ $B^2$. On it is a loose sleeve C, to which are made fast a gear, D, and a spider F carrying epicyclic pinions $F^1$ $F^1$. Pinions L and G are likewise keyed to this shaft and a clutch O provides for direct connection between the shaft and the gear D. When this is done the gear is in the high speed, and power is transmitted through the shaft J, the detachable and flexible coupling $J^1$ N $M^3$, and the worm shaft m to the wheels.

Surrounding the pinions $F^1$ $F^1$ is an internally-toothed brake ring H, and when this is gripped (the clutch O being released) the centre $F^2$ of the pinions $F^1$ are made to travel at half the pitch line velocity of the pinion G, and in the same direction, and this constitutes the slow forward speed. The studs $F^2$ carry at their further ends another internal gear I, which surrounds another set of epicyclic pinions $K^1$, mounted on a second brake drum K. When this drum is gripped (the other being released), the motion is transmitted in a reverse direction from the pinion L, through the pinions $K^1$, to the internal gear I, and thence to the spider F and the gear D, which thus obtains its slow reverse motion.

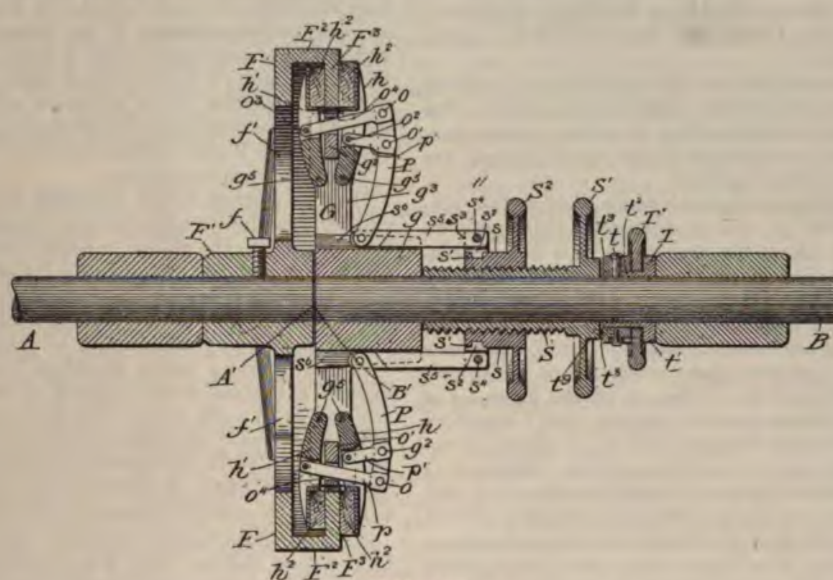
The body P of the car swivels, turnable fashion, on the rollers S, and is locked in either of its two normal positions to the truck frame R. The coupling between the shafts J and M is of the universal joint variety, to permit rocking of the body on the axle-box spring. The ends of the short shaft N are made spherical, and transverse pins through them work in grooves in the sockets $M^3$ and $J^1$. By throwing over the lever $N^2$ the left hand end of N may be withdrawn from the socket $M^3$, to be entered in the socket $M^4$ when the body has been swiveled into its opposite position.



651,816—Friction Driving Clutch.—Martin Backstrom, of Chicago Heights, Ill., assignor to the Canedy Otto Mfg. Co., of same place. June 19, 1900. Application filed Sept. 18, 1899.

This clutch is arranged to couple automatically when the driving half is rotated in the designed direction, and to uncouple when the driving half is retarded or reversed. It is in effect a substitute for the ratchet and pawl.

every other stroke of an eccentric rod worked from the crank shaft. A short shaft carries a ratchet wheel and a star wheel, the former having double the number of teeth that the latter has, and being rotated one tooth for each revolution of the crank shaft. The star wheel is so arranged that its teeth act on a lever controlling the exhaust valve. Other details are shown and claimed.



651, 842.

651,842—Friction Clutch.—James T. Ford, of Galveston, Texas. June 19, 1900. Application filed Aug. 18, 1899.

In this clutch either A or B may be the driving shaft. A suitable spider carries the two wood friction rings $h^2$ $h^2$, and another spider carries the gripping levers and shoes $h^1$. These are gripped by a movement to the left of the ring $s^2$, which is controlled by the nut and handwheel s $S^2$, running on the threaded sleeve S. Evidently if while the shaft is running in a given direction one of the handwheels be braked or retarded by the hand it will result in screwing the nuts along the sleeve in a corresponding direction; while if the other wheel be retarded the nut will be screwed in the opposite direction.

651,966—Explosion Engine.—Georges A. Fleury, of Paris, France, June 19, 1900. Application filed June 27, 1899.

This engine was described under the head of British Patents in our issue of June 13.

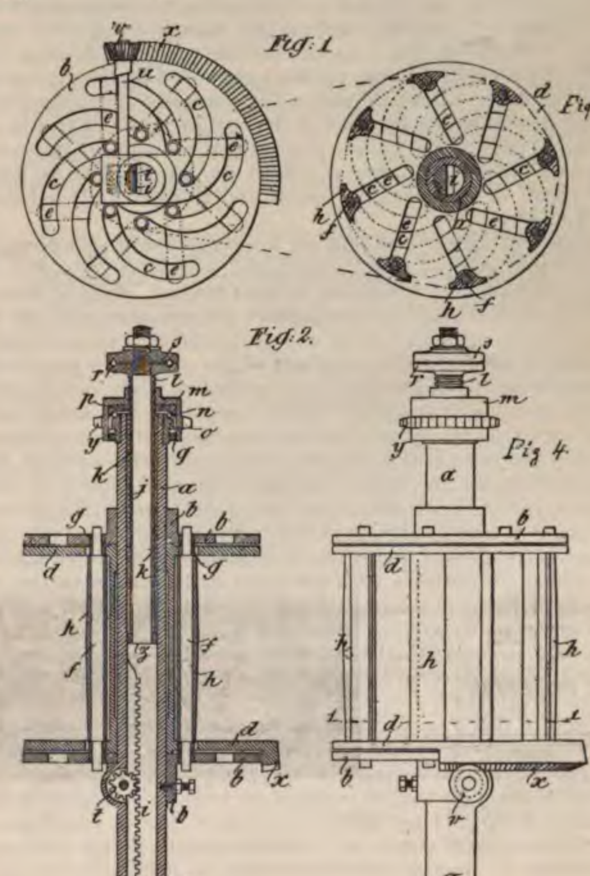
652,006—Automobile.—John C. Rantz, of Williamsport, Pa. June 19, 1900. Application filed Sept. 16, 1899.

652,092—Variable-Diameter Pulley.—Chas. Desprez and Georges L. Duthuit, of Paris, France. June 1, 1900. Application filed Jan. 31, 1900.

This is an interesting contribution to the numerous attempts to solve the problem of an expansible pulley. Its construction and principle are fairly clear from the drawings. The disks b, with the curved slots, are made fast on the hollow shaft. The disks d, with the straight slots, form as it were the heads of a spool, and are rotated on the shaft by a bevel pinion v, meshing with the segmental bevel gear x. The slots which combine to make up the pulley face have round ends, which enter the slots and are located by the relative positions of the disks b and d. A rack i, longitudinally movable inside the shaft, rotates a spur pinion keyed to the spindle which carries the bevel pinion v.

651,683—Valve Gear for Gas Engines.—Chas. Werner, of Pine Grove, Pa. June 12, 1900. Application filed Sept. 14, 1899.

A ratchet and star-wheel device for opening the valves at



651,741—Explosive Liquid Air Engine.—J. C. Anderson, of Highland Park, Ill. June 12, 1900. Application filed Dec. 9, 1899.

In this engine a liquid hydrocarbon is intended to be mingled with the liquid oxygen obtained from liquid air, and exploded in combustion chambers, whereby power is derived from its expansion. The details of the engine's design, which are shown and claimed, appear to be of little practical value.

651,742—Method of Moving Pistons of Explosive Engines.—J. C. Anderson, of Highland Park, Ill. June 12, 1900. Application filed Dec. 9, 1899.

In this patent is claimed the use of liquid oxygen, derived from liquid air, in connection with a liquid hydrocarbon. The engine described in the preceding patent is shown. Some passages from the opening paragraphs of the specifications are given below, together with the claims:

It is well known that liquid air is the result of excessive compression of atmospheric air, and is composed principally of nitrogen and oxygen in about the proportion of 4 to 1, respectively, and that when placed in an open vessel it will, by absorption of heat from the surrounding atmosphere, throw off a much larger proportion of nitrogen than oxygen, thus leaving the latter in a more concentrated condition, and hence more available as an explosive agent when mixed in suitable proportions with hydrocarbon. It is one of the purposes of my invention to take advantage of this fact, and I therefore contemplate purposely eliminating to a large extent the nitrogen constituent of liquid air, and to thus not only deprive it of a constituent which tends to retard or quench combustion, but at the same time to put the oxygen in such condition that it will sustain rapid combustion when mixed in suitable proportions with hydrocarbon, and hence when such combustion takes place in a closed chamber, opening to the piston of an engine, the force and efficiency of the engine will be proportionately increased. In utilizing liquid air thus denitrogenized and mixed with hydrocarbon as an explosive agent or driving the piston I am enabled to use the heat generated by the explosion to successively expand the succeeding charges of denitrogenized liquid air and hydrocarbon, and thus utilize such expansion as an initial force to partially move the piston, while at the same time the heated chamber is cooled during the time of such expansion of the contained gases and restored to its normal temperature.

Instead of using the liquid air from a closed or sealed vessel I place it in an open vessel surrounded, except at the orifice at the upper end, with a vacuum, so that the only point at which heat of the surrounding atmosphere can combine with or be absorbed by the liquid air to any great extent is through said opening or orifice at the upper end of the receiver or reservoir, at which point the nitrogen is permitted to freely escape, and as the escaping nitrogen at its low temperature comes in contact with the atmospheric air the latter is cooled or refrigerated to such an extent as to retard, if not altogether prevent, its entrance within the receiver or reservoir, and owing to the relative specific gravities of the components of liquid air the oxygen will tend to segregate below the nitrogen and may be drawn off in desired quantities from such locality and mingled in suitable proportions with the liquid hydrocarbon in the explosive chamber of the engine and there duly expanded, ignited and exploded, as will be presently explained.

It will be understood that, when considered as a source of power, liquid air of necessity represents the equivalent amount of force required for its production. In other words, a given amount of liquid air contains an amount of energy equal only to the force exerted in the production of the liquid air; but said air represents concentrated energy, and hence an amount of force adequate for a given purpose can be carried in much more compact form and in less bulk than it would be possible to carry the apparatus required to produce the liquid air, and consequently my improved method may be utilized with very great advantage for driving engines employed to move vehicles of all kinds, such as the ordinary automobile, in which the motive power should be of limited weight in proportion to the capacity. For instance, if liquid air, or ordinary compressed air, be employed expansively as a motive force, it becomes necessary in the case of liquid air to use very strong and heavy cylinders to contain the same, and in the case of the ordinary compressed air it is necessary that the containing cylinders or reservoirs should not only be very heavy and strong, but that they should be of large capacity or size, so that it will be seen, as hereinbefore explained, in the employment of my improved method I am enabled to carry a large amount of motive force within a comparatively limited space, and that by reason of the open condition of the liquid-air cylinder or containing vessel said vessel need not be made strong and heavy, as would be the case if the liquid air were sealed or confined.

The claims are as follows:

(1) The method herein described for driving the pistons of explosive engines, which consists in mixing with a closed chamber, opening to the piston, a predetermined quantity of liquid air deprived wholly or in part of its nitrogen constituent, and a predetermined quantity of hydrocarbon or equivalent agent, and exploding the gases resulting from such admixture, by the application of an electric spark or otherwise.

(2) The method herein described for driving the pistons of explosive engines, which consists in first depriving liquid air wholly, or in part, of its nitrogen constituent; second, mingling in a closed chamber opening to the piston, a predetermined quantity of the denitrogenized liquid air, with a predetermined quantity of hydrocarbon, and finally igniting and exploding the combined gases within said chamber.

651,743—Detachable Cover for Pneumatic Tires.—Thomas Caldwell, of Bolton, and Wm. Caldwell, of Leigh, England, assignors, by mesne assignments to the Radax Pneumatic Tyre Co., of Warrington, England. June 12, 1900. Application filed July 18, 1898.

This invention is claimed a cover for inner tube tires which, when the tire is inflated, will firmly hold to and remain on a wheel rim of any suitable concavity without any side wires or thickened edges or parts to lock into the rim; in fact, without adding any holding-on devices at all. In this patent and in a following one, No. 657,745, which is a divisional patent, the method of constructing the cover is described.

Fig.1.

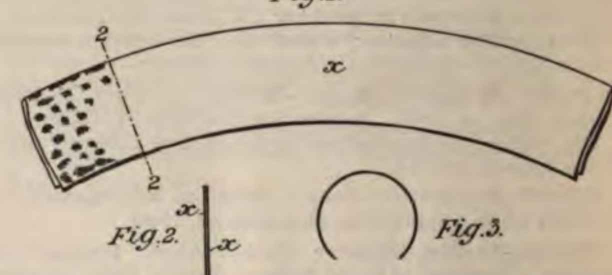


Fig.2. Fig.3.

The cover is woven in a flat U section, as shown in Fig. 2, and of curved contour, Fig. 1. It is then stretched in suitable stretching apparatus till the stretch is all taken out of it, and is then wrapped around a form, about three layers deep, cemented with rubber solution, and vulcanized, with a rubber tread to protect it from wear. Fig. 3 shows the form assumed by it in use, and it is claimed that when the fabric is fully stretched, and the inner tube is inflated, the cover will grip the rim and will not spread.

651,780—Internal Combustion Motor.—Henry T. Dawson and Henry A. Dawson, of Canterbury, Eng. June 12, 1900. Application filed July 10, 1899.

This motor was described and illustrated in The Horseless Age of May 23, 1900. The claims are as follows:

(1) In an internal combustion motor, the combination of, a

combustion cylinder; an air cylinder forming an enlarged continuation of the combustion cylinder; a combustion piston; an annular air piston in one with the combustion piston; a crank shaft; a piston rod connecting the piston and crank shaft; an admission valve; an exhaust valve; an ignition device; a valve box; a port opening from the valve box into the combustion cylinder; a port opening from the air cylinder into the valve box; an air reservoir communicating with the said valve box; a valve fitted to said reservoir normally adapted to admit air into said reservoir and prevent its return therefrom; a non-return valve located in the said valve box and adapted to open and close the port opening from the air cylinder into the valve box, and means for moving the said non-return valve by hand, substantially as and for the purposes set forth.

(2) In an internal combustion motor the combination of a combustion clyinder; an air cylinder forming an enlarged continuation of the combustion cylinder; a combustion piston; an annular air piston in one with the combustion piston; a crank shaft; a piston rod connecting the piston and crank shaft; an admission valve; an exhaust valve; an ignition device; a valve box; a port opening from the valve box into the combustion clyinder; a port opening from the air cylinder into the valve box; an air reservoir communicating with the said valve box; a valve fitted to said reservoir normally adapted to admit air into said reservoir and prevent its return therefrom; a non-return valve located in the said valve box and adapted to open and close the port opening from the air cylinder into the valve box, an augmenting valve also located in the said valve box, connected to the non-return valve and adapted to open and close the port opening from the valve box into the combustion cylinder, and means for moving the said non-return and augmenting valves by hand, substantially as and for the purposes set forth.

(3) In combination, the non-return valve 15, the augmenting valve 18; the tail 19 on the non-return valve jointed to the augmenting valve; the ports 16 and 25; the pivoted hand lever 21; and the rod 20 connecting the augmenting valve 18 and the hand lever 21, substantially as and for the purposes set forth.

(4) In combination the valve box 17; the non-return valve 15; the augmenting valve 18; a recess 129 in the back of the augmenting valve; a blade spring 50 having one end turned over; a pin 128 on the said turned over end of the blade spring adapted to engage in the said recess; and lateral guides 130 on the back of the said non-return valve adapted to receive the other end of the said non-return valve, substantially as and for the purpose set forth.

(5) In an internal combustion motor the combination with the cylinder, piston, piston rod, crank shaft and valve, of a shaft rotatable at the same speed as the crank shaft; a non-circular portion of the said shaft set at an angle to the length of such shaft; a disk; a non-circular hole passing obliquely through said disk and adapted to receive the said non-circular portion of the shaft with a sliding fit; lateral guides for the said disk; a strap surrounding said disk; a rigid connection between said strap and the said valve; means for moving the said shaft in the direction of its length; and means for rotating the said shaft; substantially as and for the purpose set forth.

(6) In an internal combustion motor the combination with the cylinder, piston, piston rod, crank shaft and admission valve, of a shaft rotatable at half the speed of the crank shaft; an exhaust valve; a spring adapted to close the said exhaust valve; a roller carried by the said spring and adapted to bear on the said exhaust valve; a cam mounted on the said shaft, having a limited backlash relatively to the crank shaft and adapted to bear on the said roller; and means for rotating the said shaft, substantially as and for the purpose set forth.

(7) In an internal combustion motor, the combination with an automatic admission valve, of a pivoted lever; an elastic tongue carried by the said lever and adapted to press open the said admission valve; and means for operating the said pivoted lever, substantially as and for the purpose set forth.

(8) In an internal combustion motor, the combination with an automatic admission valve, of a pivoted lever; an elastic t ngue carried by the said lever and adapted to press open the said admission valve; and a pivoted hand lever adapted to operate on the said pivoted lever, substantially as and for the purpose set forth.

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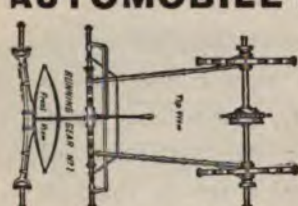

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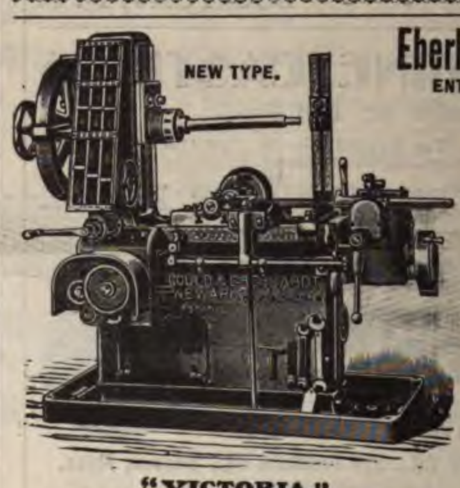

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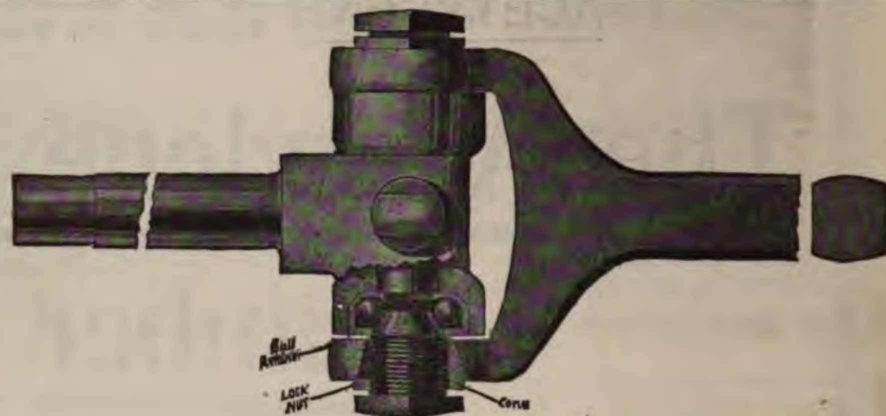


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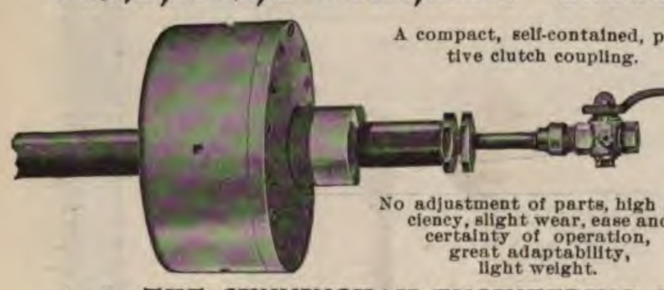

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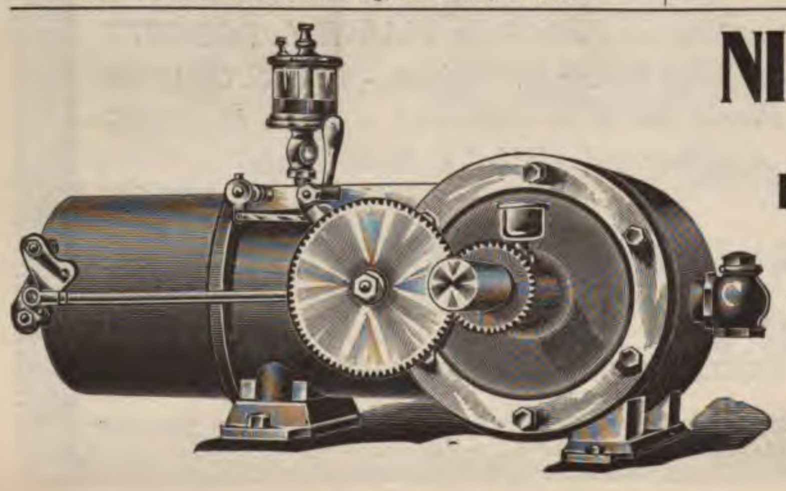

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# THE HORSELESS AGE

...EVERY WEDNESDAY...

Devoted to Motor Interests

VOLUME VI — NEW YORK, JULY 11, 1900 — NUMBER 15


## THE HORSELESS AGE.


E. P. INGERSOLL, EDITOR AND PROPRIETOR.

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### COMMON SENSE AND SPEED LIMITS.

THE subject of motor vehicle speed regulation has been agitating the law givers of Bridgeport, Conn., and last week an effort was made in the common council to pass an ordinance restricting the speed of motor vehicles to seven miles an hour within one mile of the railroad station, a radius which includes all of the business section of the city and a good deal of the residential portion. It was explained by those favoring the ordinance that no complaint was made of the manner in which the employes of the Locomobile Company of America handled the company's vehicles, but that the public was in danger from inexperienced operators, whom it was necessary to hold in restraint.

When the ordinance was reported by the committee, it was moved to amend by making the radius two miles instead of one, on the ground that citizens and children in the outskirts were as much entitled to protection as those nearer the centre. After a discussion the amendment was carried, and the amended ordinance was then defeated, it receiving 8 votes out of 13 and requiring 11 for passage. An attempt at reconsideration on a compromise radius of one and one-half miles subsequently failed, and it appeared that only eight members favored the one-mile limit.

The Bridgeport *Union* makes some sensible comments on the incident : "An automobile under control of the driver," it says, "may be run at 10 or even 12 miles an hour with almost no risk; even at such a rate it can be stopped almost instantly, certainly with much more celerity than can a bicycle. But if it gets away from the control of the driver, then an automobile in a busy thorouhgfare is a terrible source of danger, and under such circumstances a speed restricting ordinance would not be a collossal source of protection to the endangered citizen. Manifestly, therefore, it is more important to provide against happenings of this nature than to pass a speed ordinance and leave obedience thereto to persons who are as likely to blow up the boiler of an automobile or to steer it up a tree as to accomplish a safe passage of the streets with the machine. What should first be done is to prohibit incapable persons from running autos at all. If the council should take up the automobile question from this standpoint and safeguard the public by a reasonable and wholly justifiable license law, it will do much better than by limiting the legal speed of automobiles to a pace scarcely twice that of a rapid walk, while leaving it legally possible for a ten-year-old boy to start a horseless carriage on an expedition which is likely to terminate at the top of a telegraph pole, in a smashing of shop windows or the killing or maiming of one or a dozen human beings. The council did well to defeat the proposed ordinance. It wasn't the right ordinance at all."

This view of the matter is eminently sensible. By all means protect the public from unskillful operators, but do it without crippling the motor vehicle in one of its prime advantages over the horse.

### THE LIQUID AIR DELUSION IN A NEW FORM.

IN THE HORSELESS AGE last week were printed some extracts from the specifications and claims of a recent patent on the use of oxygen derived from liquid air, as a substitute for free air in the cylinders of explosion motors. In reciting the advantages of his invention the patentee set forth that not only would the oxygen yield up the energy represented by

its reduction to the liquid state, but it would be much more efficient in combustion, owing to the absence of the inert nitrogen which commonly tends to retard combustion, and which absorbs heat which cannot be fully abstracted and is therefore wasted.

That there is some measure of justice in these claims there is no reason to deny. The practical question is, how much are the advantages attending the use of liquid oxygen to cost?

Exact figures in answer to this question could be obtained only by experimenting, as the thermodynanic processes of combustion, absorption and conversion of heat would be materially different with the concentrated and cold oxygen from what they are with free air at ordinary temperatures. Some features of the case, however, may be pointed out, which will indicate broadly what results may be expected of experiments in this direction.

A gallon of liquid air, according to Chas. E. Tripler, can be produced at a cost of about 20 cents. As the proportion of oxygen in the air is about one of oxygen to five of air, five gallons of liquid air would need to be produced to obtain one gallon of liquid oxygen. One volume of liquid oxygen represents about 750 volumes of free oxygen at atmospheric pressure and ordinary temperature; so that the cost of free oxygen, produced from liquid air, would be between nine and ten dollars per 1,000 feet.

An average gasoline engine will use about 13,000 cubic inches of air per horse-power per minute. Ignoring for the moment the expansive effect of the liquid oxygen and the differences in the rate of combustion, etc., the amount of oxygen in this air is about 2,600 cubic inches per horse-power per minute. Taking the cost of 1,000 feet of free oxygen as $9.50, we should have a trifle over 17,000 cubic inches for $1; and this, used at the rate of 2,600 cubic inches per minute in a one-horse-power gasoline engine, would last just 66 minutes!

The gasoline consumed in the same period would cost rather less than two cents.

But will not the elimination of the nitrogen diluent and the addition of the expansive force of the liquid gas add very largely to the power above estimated? And will not the refrigerating effect of the liquid gas render jacket-water unnecessary, thus further increasing the economy?

To some extent, yes. But one-half of a brake horse-power hour is the most that can be expected from one gallon of liquid air or oxygen, when warmed to, say, 150 degrees Fahr., and adding its quota to the pressure behind the piston. Fully three gallons would be needed to absorb the waste heat of combustion, and a water jacket will still be necessary. The losses in the exhaust will be less because the weight of gas is less; but the jacket losses will be larger because of the necessity of reducing the temperature of the combustion. The compression will need to be very much less than when air is used, to prevent the combustion from being unmanageably violent; and this means that the oxygen and vapor will be largely diluted by burned gases instead of by nitrogen. Altogether, it seems most unlikely that over two horse-power hours at the utmost can ever be looked for from the burning of a gallon of liquid oxygen in an explosion engine.

It would be far more sensible to use the liquid air, nitrogen and all. With careful design, it would then be possible to dispense with the water jacket and that source of waste could be stopped. Part of the energy thus saved would be utilized in heating and expanding the liquid gas, and five times the power would thence be obtained as with the oxygen alone. The ratio of expansion would be independent of the volume of air used, and could be made as high as desired. The compression stroke at present necessary would be discarded, and engines would run on a two-stroke cycle with no negative work to be done. A horse-power thus generated would cost much less than a horse-power derived from oxygen alone.

But liquid air will have to be a lot cheaper than it is before it can compete with air that costs nothing at all.

## AN AMENDMENT NEEDED.

THE Jamestown Ferry Company, whose boats afford the only means for vehicles to reach Narragansett Pier, has refused to carry vehicles propelled by gasoline, and Newport automobilists are warm over the decision. Some strong protests were made, but the company appealed to the supervising inspector-general, who decided that section 4472 of the Revised Statutes absolutely prohibits the ferriage of naphtha or gasoline on either freight or passenger steamships.

Of course the statute was framed before automobiles were thought of as popular means of transport, and in view of the rapid extension of their use the situation created by the statute, if it should be generally applied, would be clearly impossible. Automobiles, whether gasoline or other, must be ferried; and to empty the gasoline tank on one shore and purchase a fresh supply on the other would be both impracticable and ridiculous. The danger involved in the fluid's retention, in the carefully guarded tanks provided for it, and with the motor quiescent, is insignificant. It is hardly too much to say that the ferryboat is exposed to more risk in the act of crossing from other boats, stress of weather, and its own boilers than it would be from half a dozen gasoline carriages A measure framed in the interest of public safety, to prevent the carrying of gasoline in bulk or in loose cans, should not be wrenched to opposed public utility. Revise the statute or amend its interpretation.

## A PERSISTENT FALLACY.

THE readers of THE HORSELESS AGE will recall the appearance and exposure in its columns, a few months ago, of the fallacy that the "shock" of the explosion in a gas engine cylinder can be "balanced" by opposing another cylinder to it, with the pistons working in opposite directions on cranks 180 degrees apart, and timing the explosions to occur simultaneously. It was then shown that, so far from being neutralized by that arrangement, the "shock," which in reality is nothing but the reaction of the engine frame from the inertia of the flywheel, is, if other things remain equal, substantially doubled. The vibration due to the piston's inertia is balanced, it is true, but the torque reaction is not.

As this subject was fully discussed and disposed of at the time, it is unlikely that further enlightenment regarding it is called for among the constituency of THE HORSELESS AGE; but

it is evident that there are others who dwell in outer darkness. In a recent much-advertised book on motor vehicles, the author so far forgets the tenets of good engineering as to mention with apparent approval a motor designed on these lines, even going so far as to say that, because action and reaction are opposite and equal, therefore, "the force of the impulse tends to throw the cylinder and bed in the opposite way to that which propels the piston, and to cause it to kick or vibrate, mparting the motion to the carriage to which it is fixed."

Unquestionably the pressure against the cylinder head "tends" to move the cylinder head and parts attached thereto away from the piston; but as the axial thrust of the piston happens to be transmitted through the connecting rod, cranks and shaft bearings, to the frame, it is evident that the pressure on the piston "tends" with precisely equal force to carry the frame and attached parts in the direction of the piston's motion. In other words, the axial pressure of the explosion is sustained entirely within the engine frame, and is no more felt outside (beyond the jar of possible lost motion and the ring of the metal if the explosion is sharp) than it would be if the rod and cranks formed a single rigid member in compression between the piston and the main bearing.

The same error appeared in a recent magazine article by a well-known authority on gas engines; and it is the more surprising in this case because the author's name is in general a guarantee of the reliability of what he says.

The fact that the action and reaction take place, not between the piston and the frame, but between the flywheel and the frame, cannot be too constantly borne in mind. To do so will save many solecisms in design and much money.

The attack of the Lead Cab Trust on the gasoline vehicle industry concerns every manufacturer of these vehicles, small builders and larger ones alike. What the trust lacks in validity of claims it will not be slow to make up in legal talent and financial strength. Even were the Selden patent a mere sieve for "holes" no manufacturer could afford to rely on his own strength in ignoring it, lest a flank attack, in the defeat of his weaker neighbor, should find his own defenses unguarded. In union is strength.

In another column we mention a thrifty practice of certain toll-gate keepers in England, of rating motor carriages as traction engines and charging accordingly, and likewise of refusing to give tickets and then levying toll on the carriage's return. The toll-gate is nearly extinct in this country, but it still lingers in Pennsylvania and New Jersey. Have our readers had trouble from being overcharged on any of these toll-roads? If so we shall be glad to publish particulars of the place, etc., for the warning of others and possible correction of the abuse.

The Buffalo Automobile Club has effected a permanent organization, and has elected the following officers: President, Dr. V. Mott Pierce; vice-president, Dr. T. J. Martin; secretary, G. S. Metcalfe; treasurer, Dr. Lee H. Smith; consulting engineer, D. W. Sowers; directors, C. J. Shepard, J. T. Budd, C. R. Huntley.

The club now has 34 active members. Six are residents of Niagara Falls. The annual dues are $10, the initiation fee $20. Life, honorary and associate members, as well as active members, will be admitted.

## MOTOR VEHICLE RACES AT NEW JERSEY INTER-STATE FAIR.

The entry blanks for the motor vehicle races, which will be given at the annual New Jersey Inter-State Fair at Trenton, N. J., have just been issued. The fair will take place Sept. 24, 25, 26, 27 and 28. The automobile exposition and races will be under the direction of E. E. Schwarzkopf, editor of the *Automobile Magazine*. The rules that will govern the show are as follows:

No charge for space allotted for exhibitions of automobiles or their accessories. Applications for exhibits must be filed with M. R. Margerum, secretary of the Greater Inter-State Fair Association, Trenton, N. J., on or before July 15. The allotted spaces will be assigned Aug. 1. The automobile catalogue will contain one page of advertisement for every exhibitor. There will be an electric charging station on the fair grounds. The stewards of the meet and the judges of the vehicles and their assistants will be taken from the members of the Automobile Club of America and the Automobile Club of Philadelphia. They will sign and present handsome diplomas to the successful competitors. All entries must be accompanied by the entry fees and must be addressed to M. R. Margerum. The entries will close Sept. 1, at noon. The automobile races will be held on a half-mile driving track 66 feet wide and will be governed by the rules of the Automobile Club of America. The program of events and prizes is as follows: First race, electric, five miles, $100 plate or cash; second race, gasoline, five miles, $100 plate or cash; third race, team, five miles, $100 plate or cash; fourth race, open championship, 10 miles, $200, plate or cash; fifth race reserved championship (open only to members of the Automobile Club of America and Automobile Club of Philadelphia, Pa., or any affiliated club of the Automobile Club of America), ten miles, Greater Inter-State Fair Cup. Entry fees for races, $10. To insure a race there must be three entries in each event.

## A MOTOR VEHICLE TOURNAMENT IN BRANFORD.

The first "Automobile Exposition and Tournament" to be held in the United States will take place at Branford Driving Park, Branford, Conn., on the 25th and 26th of this month. There will be a parade and races each day, the former for silver cups and latter for cash prizes. Branford Park, in Branford, eight miles from New Haven, has one of the widest and best banked half-mile tracks in the United States. A covered building, 50x150 feet, is provided for exhibiting and contesting vehicle owners, and another building for the exhibition of motor vehicle parts and appliances.

The list of events includes the following:

Class A—Two-wheeled vehicles, motor bicycles, tandems, etc. Five miles.

Class B—Three-wheeled vehicles. Five miles.

Class C—Four-wheeled vehicles, 500 lbs. or under. Five miles.

Class D—Four-wheeled vehicles, 500 lbs. and over.

Class E—Obstacle race. Open to all styles of vehicles, excepting bicycles and tandems.

Class F—Hill climbing. Open to all vehicles without pedal assistance.

Class G—Brake test. Open to all vehicles.

Class H—Grand championship, ten-mile handicap. Open to first and second prize winners of events in Classes B, C and D.

Class I—Grand parade. Open to all styles of vehicles, for the best appearance, with silver cups to winners in all of the above classes.

The idea of the management is to have the general exhibition each day, from 10 a. m. to 2 p. m. The parade will begin at 2, and the races at 2:30 o'clock.

Manufacturers and owners of motor vehicles are invited to enter. Correspondence should be addressed to the chairman, International Automobile Exposition Committee, 268 Massachusetts avenue, Boston.

## AUTOMOBILISM AT THE PARIS EXPOSITION.

By P. M. Heldt.

It was to be expected that automobilism—one of the newest of industries and one in which France leads the way, at least as far as quantitative considerations go,—would be well represented at the Paris Exposition of 1900.

These expectations are entirely justified by the space allotted to this branch of manufacture and by the number of vehicles exhibited.

The main exhibit of automobiles is at the Champ de Mars, in the Transportation Building, right beside the exhibition of cycles and that of horse-drawn vehicles. As a large number of automobile manufacturers are recruited from the ranks of cycle manufacturers and carriage builders, many of the exhibitors in this section display both cycles and automobiles, or horse-drawn carriages and automobiles, and on account of the arrangement that these "dual" exhibitors are placed between the two sections of which their exhibits form part, the three lines of exhibi's mentioned above merge gradually one into another.

The accompanying cut, Fig. 1, is from a photograph of one-half of the French section, taken from the galleries. There are at present in the French automobile section, at the Champs de Mars, about 140 vehicles, not counting motor bicycles, tricycles and quadricycles. The for-ign nations exhibiting automobiles at the Champ de Mars are America Belgium, Switzerland, Austria and Germany, showing together between 40 and 50 vehicles.

It was recognized very early that the space available at the Champ de Mars for automobile exhibits would not satisfy the demands of automobile manufacturers, especially as there would be no opportunity for showing the machines in operation. Accordingly it was suggested to have an annex to this section at the Bois de Vincennes, about six miles away from the main fair grounds, and just outside the city limits of Paris. Although French automobile manufacturers showed considerable indisposition to take extra space at Vincennes, basing their apathy on the belief that the isolation and inaccessibility of the place would deter large bodies of visitors from coming here, the plan was realized, a special building having been erected here for the accommodation of parties wishing to exhibit automobiles and accessories. This building is a long, low, one-story affair, and has at least the same floor space occupied by automobiles as at the Champ de Mars. It is divided into three equal parts, two of which are occupied by French exhibitors while the third is reserved for foreigners. The foreign nations represented here are Italy, England, the United States and Germany.

During the automobile fêtes at the Bois de Vincennes the French section of the automobile building at this place was about filled with vehicles, but most of these were afterward removed by the exhibitors.

Fig. 1.—A Part of the French Section at the Champs de Mars.

In the American section there are exhibited four Columbia electric vehicles and two locomobiles, while a number of the spaces retained by American firms are yet empty. In the German section there are about a dozen vehicles, while the English and Italian sections are still unoccupied.

There is also an exhibit of automobiles in the Army and Navy Pavilion, intended to call attention to the services the automobile may render in warfare. Another exhibit is in the Colonial Section. Here are shown automobiles for use in the colonies. Besides this there are a number of miscellaneous vehicles to be seen in various parts of the exposition, exhibited by parties whose main exhibit is in another line, and which are therefore located in other sections of the exposition.

In connection with the exposition a number of automobile

contests are held. The first of these, a contest of touring vehicles, was held the 14th, 15th, 16th, 18th and 19th of May, starting from the Bois de Vincennes and making a trip into the country and back; 50 km. were made every forenoon and 100 km. every afternoon. Speed did not count in these contests, and the competitors were not allowed to make more than 20 miles an hour in the open country and 13 miles an hour when passing inhabited districts. The vehicles receiving first prizes (gold medals) in these contests were: one Peugeot, one Delahaye, two De Dietrichs and one Panhard.

On May 20 an automobile fête was given at the Bois de Vincennes which drew some 50,000 visitors to the woods. The program consisted of an automobile parade on the track encircling the Lake Daumesnil, and of "tours d'adresse," or trick driving in front of a grand stand which had been erected for members of the Automobile Club. The first event of the latter consisted of a number of motor cyclists passing up and down at a lively gait holding between their teeth a spoon containing an egg. Another number consisted in passing between obstacles, etc.

From the 18th to the 23d of June there will be a similar contest between vehicles for public conveyance. From the 23d to the 28th of July will occur a speed contest or race; from the 13th to the 18th of August a contest of light vehicles; from the 17th to the 22nd of September a contest of light delivery vehicles, and from the 8th to the 13th of October a contest of heavy vehicles of all kinds. All these contests will take place at the Bois de Vincennes.

After having given a general outline of the division of automobile exhibits, and of the automobile events which will take place in connection with the exposition, we shall pass to a description of some of the vehicles shown. With the great number of these, it is, of course, impossible to describe every type. But many of the vehicles are already familiar to the readers of THE HORSELESS AGE, while there are others which do not present any marked novelty nor good engineering taste, and do not therefore merit a description.

The Société Anonyme des Automobiles et de Traction exhibit a vehicle of the Bardon system. It is a "Duc," single seat, but has a detachable rear seat for one or two persons.

The motor is of the well-known double piston type. It has a single cylinder only. Ordinarily, in this type of engines the pistons are connected, by means of links and levers, to cranks on a single crank shaft. This construction is objectionable on account of the large number of bearings to be looked after, and on account of the complication and cumbersomeness. In the engine under consideration there is a crankshaft at each end of the cylinders and each piston connects to one of the crankshafts. The engine is provided with four small flywheels. It has a bore of 88 mm. (3.4″), and the stroke of each piston is 100 mm. (4″). The rating of the engine is 5 h. p.

FIG. 2.—BARDON "DUC," FOUR PASSENGERS.

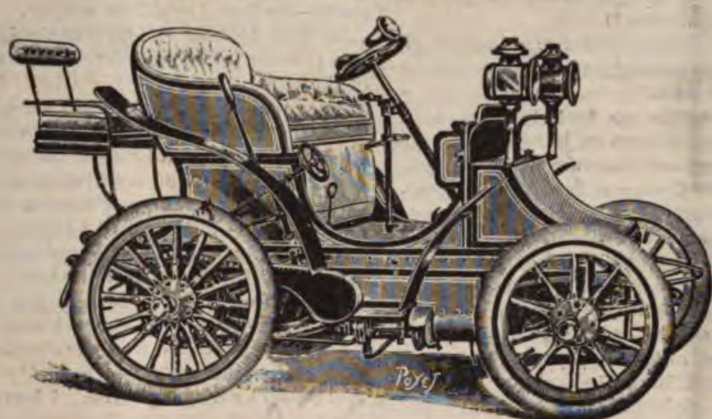


FIG. 3.—BARDON "DUC," THREE PASSENGERS.

There is a shaft running parallel with the engine cylinder, which is geared to the two crank shafts by means of bevel gears and pinions. This latter shaft, therefore, connects the two cranks and assures their proper relative motion. On this shaft there is a sleeve which ordinarily turns loosely, but which may be made fast to the shaft by means of a friction clutch. On the sleeve are keyed three spur pinions, which may be shifted along it and thus be made to engage with corresponding spur gears on a counter or divided shaft. The engagement of the various pinions and gears takes place one after another. All the gears are inclosed in aluminum cases. The countershaft carries the differential gear and is provided with sprocket pinions on either end, from which the power is

transmitted to the rear wheels by means of chains. In the rear part of the vehicle is located the water tank, while the condensing pipes are placed in front. A small rotary pump driven by friction from one of the fly wheels assures a rapid circulation of the cooling water. The muffler is seen in the diagram between the rear axle and the countershaft.

The vehicle has three forward speeds and one reverse. The forward speeds are 5½, 11 and 27 miles per hour. By means of a spark shifting device, intermediate speeds may be obtained. Three brakes are provided, one acting on the differential, one on the brake wheels forming part of the sprocket wheels, and the third acting directly on the wheel tires.

## THE AMERICAN BRIDGE CO.

The American Bridge Company has been organized by the coalition of the following companies:

American Bridge Works, Chicago, Ill.
Berlin Iron Bridge Co., East Berlin, Conn
Buffalo Bridge & Iron Works, Buffalo, N. Y.
Carnegie Steel Co., (Keystone Plant) Pittsburg, Pa.
Edge Moor Bridge Works, Wilmington, Del.
Elmira Bridge Co., Elmira, N. Y.
Gillette-Herzog Mfg. Co., Minneapolis, Minn.
Groton Bridge & Mfg. Co., Groton, N. Y.
Hilton Bridge Construction Co., Albany, N. Y.
Horseheads Bridge Co., Horseheads, N. Y.
Lafayette Bridge Co., Lafayette, Ind.
Lassig Bridge & Iron Works, Chicago, Ill.
N. J. Steel & Iron Co., Trenton, N. J.
New Columbus Bridge Co., Columbus, O.
Pittsburg Bridge Co., Columbus, O.
A. & P. Roberts Co., (Pencoyd Iron Works) Pencoyd, Pa.
Post & McCord, Brooklyn, N. Y.
Rochester Bridge & Iron Works, Rochester, N. Y.
Schultz Bridge & Iron Works, Pittsburg, Pa.
Shiffler Bridge & Iron Co., Pittsburg, Pa.
Union Bridge Co., Athens, Pa.
Milwaukee Bridge Co., Milwaukee, Wis.
Wrought Iron Bridge Co., Canton, O.
Youngstown Bridge Co., Youngstown, O.

This list contains all the leading companies that manufacture bridge and structural work in this country, with the combined capacity of 600,000 tons per annum.

The executive organization is made up entirely of men of large practical experience, headed by Percival Roberts, Jr., one of the leading rolling mill managers of the country. The Pencoyd plant of the A. & P. Roberts' Company has all been developed under his personal supervision. The engineering department is in charge of Charles C. Schneider, formerly chief engineer of the Pencoyd Iron Works, with the title of vice-president, in charge of engineering. At different localities throughout the country is distributed a corps of designing engneers to prepare preliminary plans and estimates, and at each plant will be located a full and complete corps of engineers and draughtsmen to prepare plans for the work fabricated at that particular plant.

The operating department is in charge of Charles M. Jarvis, formerly president of the Berlin Iron Bridge Company, with the title of vice-president in charge of operating.

All the sales of the company are in charge of the contracting department. This is divided into three distinct parts, railway contracting, highway contracting, structural contracting.

The last-named department is in charge of W. H. McCord, formerly of the Post & McCord Company. The preparations of all proposals and contracts is in charge of this department. The company have opened contracting offices in different parts of the country, each office reporting daily, by wire, to various members of the contracting department.

The mechanical department has been made of equal importance with all other departments, and has been placed in charge of James Christie, formerly mechanical engineer of the Pencoyd Plant, with the title of vice-president..

The financial department is in charge of William H. Connell, formerly president of the Edge Moor Bridge Works, as treasurer.

The purchasing department is in charge of Francis W. Heisler, formerly purchasing agent for the Edge Moor Bridge Works, with headquarters at 259 South Fourth street, Philadelphia, Pa. The secretary of the company is Douglas O. Morgan, fomerly a member of the law firm of Seward, Guthrie & Steele.

# LESSONS OF THE .. .. ROAD .. ..

## ANOTHER STEAM CARRIAGE.

CHICAGO, June 25.

*Editor* HORSELESS AGE:

I have been an owner of a steam carriage since the first of January. The following are a few of the troubles I experienced before I "learned a thing or two." Would like to say that I am a mechanic and have designed and built engines, boilers, etc.

When I filled my boiler for the first time I found that I had to wait for gravity to fill it from the water tank, and gravity was rather slow, taking about sixty minutes, so I had a small hand pump made and now I can fill an empty boiler in three minutes.

The very first ride I had on the machine I discovered that my feed pump was too small, as it would not keep water in the boiler. The pump plunger was one-half inch in diameter; it is now nine sixteenths in diameter and is all right.

I have added also a small injector and I have found it a friend indeed several times. If your boiler is liable to pop you can start your injector and keep steam down.

My gasoline tank holds three gallons, and is listed for 70 to 80 miles. I found out to my sorrow, when 10 miles from nowhere, that three gallons of gasoline will run about 35 miles. I now have a seven-gallon tank. My water tank holds 17 gallons and by using all the spare room in the machine I now carry 26. The original water tank was supposed to run 40 miles—the best I could do was 30.

My next trouble was having the fire blow out. I have stopped this trouble by using a very fine brass gauze over the bottom of the burner.

After these troubles I set my machine on fire and had to have it repainted because I tried to start my fire with the "torch" too cold. After this I varied the monotony by breaking water gauge glasses—found my fittings were not in line. Since lining up my fittings I have not broken a glass. When 20 miles out in the country I discovered I could not keep water in my boiler, and after three stops and cleaning checks I found that the wire strainer at the bottom of the tank was stopped up with mud. I have since cut this out and put in a strainer that I fill the tank through, so I can clean it with very little trouble.

During the trouble with the stopped up strainer I would have been lost without the injector. My water tank is connected to feed pump by a rubber hose. I have substituted an expansion joint.

Next my crank sprocket came loose and I had to take out the engine and take crank bearings all apart to get at the screws. These screws were upset a little to keep them from working out. They are put in now with a lock nut on the back side.

I found my crosshead pins cutting because of no oil. They would run dry in 15 miles. They now have an oil cup on each and will run 100 miles. The next thing on the program was trouble with the regulator. After the regulator shut off the fuel it would not open up again. I found out that it was drilled very much out of line. After rechucking and drilling it worked all right. I also found the steam side of diaphragm full of mud so the regulator could not open wide. Have also put a valve in the steam pipe to regulator, so that if the diaphragm breaks I can come home without any trouble.

The rocker arm for feed pump, with a slot in it worked by the crank pin, wore so badly that the neighbors could hear it, so I had to change this and connect the rocker arm to the crank pin by a link. This made a very good job and the pump is quiet now.

Next I took an indicator card from my engine and found there was too much back pressure. I had to cut out one-eighth inch from the exhaust port in the slide valve.

I have also placed a sheet iron flue so as to carry the exhaust steam down from the water tank below the rear axle; now the steam is thrown on the ground and not over the rear wheels—no more engine oil all over my wheels.

My air or pressure tank is too light to stand the pressure, as it is continually springing a leak and is still leaking. I shall have to put in a new tank to remedy this trouble. Next the crossheads have worn and there is no way to take up the wear. So I have made new ones that I can adjust. The slides are put on with two screws and will work loose unless held on by lock nuts.

The following are a few things I have put on for my own convenience:

A feed water heater. My steam will stand at about 160 lbs. without feed pump running, and with pump running at about 100 lbs. Since putting in the heater my steam does not drop 5 lbs. with the pump running. The heater is very simple, nothing but a coil of pipe in the exhaust tank. This coil of pipe with water in it also condenses about 50 per cent. of your steam.

Three air cocks have been added on the gasoline tank so I can tell where the gasoline is.

The gong has been moved so it can be rung by the left heel near the seat.

I use a small storage battery and lamp so that I can see the water glass after dark.

I have made a lock for the throttle.

Have put valves in between the boiler and boiler checks, so I can put in a new glass without blowing off the boiler to get the checks off their seats. The pop valve now discharges into the water tank, and makes practically no noise.

Have put a cock in the bottom of gauge glass fitting so I can clean out the glass with a rag and stick without taking it out.

Have put on larger and better lubricator, have also put on a water column and try cocks.

Have also made an air pump connected to the engine similar to the water pump, so I can pump up the air tank any time it needs it when the engine is running.

The following things I consider should be changed:

The front and rear wheels should track.

The wheel base should be longer, as it will shake you out of your seat when you strike a crossing as it is now. The steering lever stem is in the centre line of the carriage; it should be directly in front of the operator.

G. W. H.

## RUNNING A BLAST FURNACE.

Few people who have not actually run a blast furnace realize what it means. According to the *Engineering Magazine*, a stack of 200 tons daily capacity, running on 50 per cent. ore, must have delivered to it each day something more than 400 tons of ore, 250 tons to 300 tons of coke, and over 100 tons of limestone, besides sand, coal and minor supplies—say 900 tons of raw materials. Add the 200 tons of pig iron product shipped out, and we have a daily freight movement of 1,100 tons, taking no note of the disposition of the slag. The mining of the ore requires the labor of 150 to 300 men; the coal mining, coke making, quarrying of limestone and transportation, at least 300 more. The furnace itself employs about 150 or more hands. Starting up a furnace of ordinary capacity, therefore, calls immediately for the labor of nearly a thousand men; for the use of at least a thousand railway cars and many locomotives, for perhaps several steamers and vessels; for capital, from the mines to the pig iron, of $1,000,000 to $2,000,000 and last, but not least, for a high order of managing ability.

# ...OUR... FOREIGN EXCHANGES

## AN ARMORED TRAIN FOR SOUTH AFRICA.

The present war has given inventors plenty of work in more than one direction. Munitions of war of every kind have received closer attention during the past six months than at any corresponding period since the Crimean War. Men totally inexperienced in war-like implements, and altogether unacquainted with the working of armies and of weapons, have made suggestions, have applied for patents for ideas which they have been pleased to call inventions, and then have blamed the Government for not immediately adopting them.

Many of the proposals which have been made for handling heavy guns, for effecting the transport of ammunition, and for the conveyance of men and material to the seat of war, have been as simple as they have been impracticable. It is interesting, therefore, to have before us the latest production from a firm who not only know what is required in connection with traction trains, but know how to apply their special experience to meet the difficulties of any particular problem in military engineering which has to be faced.

John Fowler & Co., of Leeds, have satisfied the requirements of the War Department, and built an armored train for siege purposes, which has more than fulfilled the expectations of the inspectors who were present at the trial, and of the designers who carried out the work.

A few days ago the trial of the armored train took place at Leeds. Besides the Directors of Messrs. Fowler & Co., there were present Lieut.-Colonel Elmslie, representing the Director-General of Ordinance, Major Hansard, R. A., Artillery Adviser to the Inspector-General of Fortifications; Captain Nugent, R. E., Inspector of Iron Structure, and many others. It was a very critical assembly who inspected and watched the trial.

The train consisted of a special road locomotive with three trucks, behind which were hooked two 6-inch Howitzers, without limbers, a special fastening being fixed to the first gun to enable the trail of the second to be attached to it. The engine, of 75 brake-horse-power, was completely armor plated with nickel steel plates, one half inch thick, supplied by Messrs. Cammell, of Sheffield, made by their private process, with some special points observed in the manufacture, so as to make it absolutely impregnable to any ordinary small arm bullet which is likely to be fired against it.

To make the engine and its train less conspicuous it was painted khaki color throughout. The armor, while being supported from the boiler, had to be made in such a manner as to be removable, and so placed that the attendants not only could lubricate the machinery, but thoroughly inspect and overhaul the mechanism connected with the cable-winding drum which is supplied on the engine, and the other ordinary working parts connected with the locomotive itself. The storage capacity of the tank is two and a half tons of water, so that a long journey can be undertaken without replenishment. As will be seen the trucks, like the engine, are armor plated. The armor throughout is Mauser bullet proof at 100 yards, and practically bullet and shell splinter proof at 20 yards.

Each truck is a veritable battery, in that it carries a Howitzer or a 4.7 naval gun, a suitable opening being made for the protruding muzzle. Stores or men can be carried instead of the gun if desired, the armor being suitably attached to admit of its use for either of these purposes.

The engine is of Fowler's compound spring mounted type, specially constructed and built so as to carry armor. The armor is in segments and arranged to be readily dismounted,

and the engine then becomes much lighter in weight and similar to Army Service type engines, now doing such excellent work in South Africa. The steam pressure is 180 lbs. per square inch, although the engine can work at higher or lower pressure to suit particular demands.

The driving power is transmitted through the crank shaft to the hind axle through a train of protected cast steel gearing with self-acting differential gear on the main axle. The ratio of the gear is such that a speed of 1½ to 3 miles per hour is made with the slow gear, 2¼ to 4½ miles per hour with the middle gear, and 8 miles per hour with fast gear. The whole of these speeds, however, can be increased by running the engine faster in cases of emergency, such as must be inevitable on the battle field.

All parts of the vehicles and engine except the traveling wheels, are protected from rifle fire by armor, but as these wheels are themselves practically of armor strength they are as invulnerable as the rest of the train. So that the attendant and driver need expose themselves as little as possible, the whole of the motions are controled from the foot brake, all levers, cocks and lubricators being so arranged as to be easily manipulated by the attendant when standing in the ordinary driving position.

Although look-out holes are provided optical science is brought into use to prevent the looking round corners that would be necessary but for the ingenious arrangement of mirrors which enable both sides to be visible, while the steersman and the driver are only looking ahead. These mirrors and lookout holes are provided with special shutters, from the design of Captain Nugent.

The patented mounted springs introduced by Messrs. Fowler & Co. carry the engine, the suspending levers being arranged in such a way in connection with these mounted springs as to enable a high speed to be maintained over rough ground without in any degree affecting the true working of the driving gear, at the same time providing sufficient cushion to obviate shocks which are given to a traveling engine when journeying over rough country.

The truck's frame is constructed entirely of steel, elasticity, however, being obtained by means of springs. The wheels are specially built with hard steel tires 12 inches wide, the hind wheels having a wide gauge to ensure stability, the front wheels being narrow in gauge to allow of a sharp turn being made with precision and safety. Each truck is provided with brake gear to work either from the outside or the inside of the truck. A spring coupling bar is provided for every truck, and suitable coupling arrangements at the tail end are made to enable the hooking up to be effected with another truck or with a trail-eye of a Howitzer. Incline ramps are carried on the truck for use in facilitating the entraining of guns. The truck bodies are built of proof steel having adjustable shutters to the sight holes which admit of a very small opening being left for sighting purposes, or a larger opening for fixing a rifle therein. The lower part of the body is made a fixture to the frame, partly at an angle, the upper part being formed of three hinged flaps on each side made to fix up when required; clamping arrangements are provided for securing the flaps when up, and locking them together when down, the flaps then forming ridge-shaped covers. When the sides are fixed up, the truck gives accommodation for the carriage of a Howitzer, ammunition, boxes or other stores. When the sides are down the truck is proof against either fire or rain and can be used for ammunition or other stores which have to be protected. Large doors in four parts are hung at the back end of the wagon for expediting loading. Fixed and movable seats are placed in the truck for the accommodation of the men when traveling.

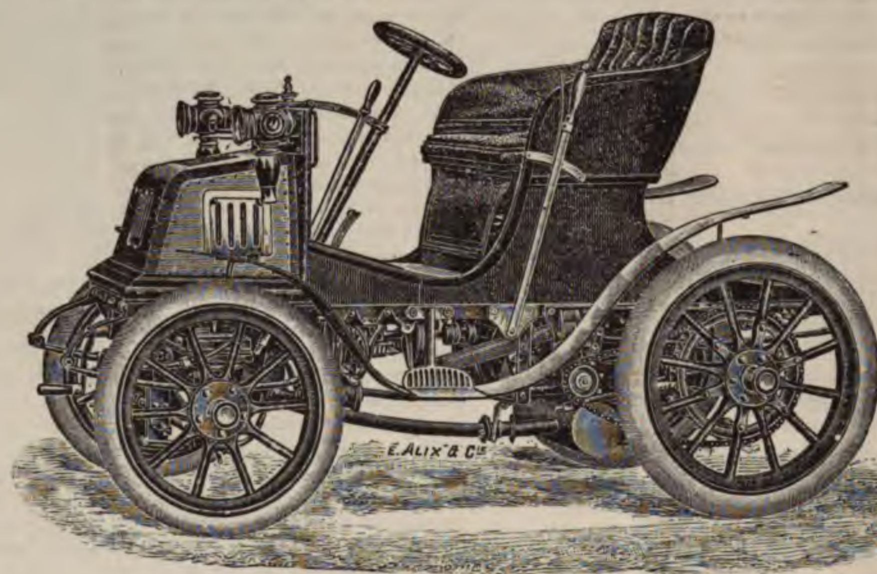


FIG. 1.—THE TOURAND VOITURE.

The train with its load of two Howitzers trailing behind the carriages, traveled over the Pontefract Road, quite easily traveling a gradient of 1 in 13½, at a speed of about seven miles an hour. The entraining of a Howitzer was carried out by first unhooking it from the truck, placing the steel ramp in position to form an inclined plane up which the wheels of the Howitzer carriage traveled. The wire cable from the drum was then attached and the gun and its carriage was hauled up without difficulty.

After traveling on the ordinary road, and putting the train through various manœuvres, it was taken across a soft and crumbling fallow recently plowed. On the downward journey all was plain sailing, but the return demonstrated that the driving wheel was revolving much faster than the steering ones in front, and ultimately the engine came to a standstill. "Spuds" in the form of great spurs of steel were fixed to the driving wheel of the engine, but to no purpose, for the soil was too rotten to afford any hold,. Then the hauling apparatus proved its value; the truck with its load moved quite easily over the soft ground, and answering in every way to the requirements and demands of those superintending the test.

The combination of this siege train illustrates the latest inventions in connection with mechanical haulage, and it is interesting from the fact that the engine carries with it not only that which will enable it to be useful as a war train, but as a road transit train for ordinary commercial purposes, wherever it may be required in South Africa.—*British Invention.*

## THE TOURAND VOITURE.

This carriage, which was briefly referred to in THE HORSELESS AGE of March 7 ult., is fully described in a recent number of *La Locomotion Automobile*, from which the following is adapted: The motor is of a balanced design patented by its inventor, F. Crozet, and is shown in section in Fig. 2. Its principle will readily be recognized by readers of THE HORSELESS AGE who followed the studies in motor vibration published in its columns a few months ago. The two cylinders $AA^1$ have a common combustion chamber, and the disc cranks C $C^1$ carry balance weights D $D^1$, of weight sufficient to counterbalance both the rods and the piston. The cranks are geared together as shown, and revolve in opposite directions, and the transverse vibratory forces of the balance weights act in opposite directions and neutralize each other. The motor is therefore in complete mechanical balance. Each crank shaft carries its own flywheel, so that the major part of the torque reaction is likewise balanced; but the power is taken from only one shaft, whose flywheel is provided with a friction clutch for the purpose, while the governor is mounted on the other shaft.

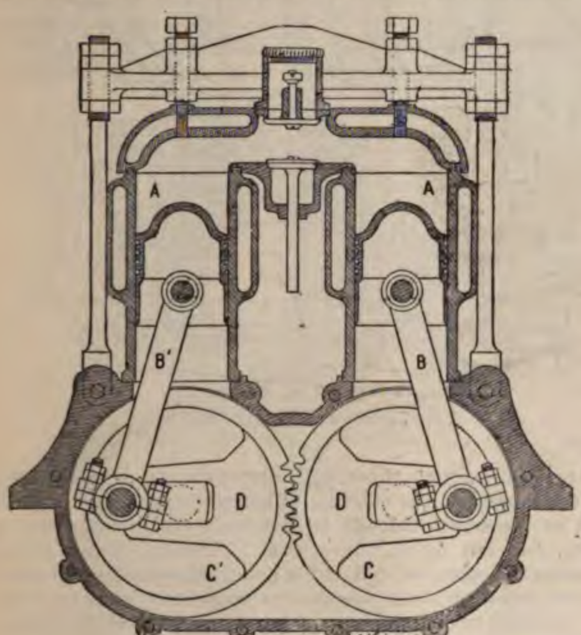


FIG. 2.—SECTION OF MOTOR.

The motor is of 7½ brake h. p. It is shown in external view in Figs. 3 and 4. The double cylinder head and the two cylinders are held to the crank case by the yoke and tie-bolts shown. The valve chamber is seen at H, with the inlet valve above and the exhaust valve below. The latter is acted on by a roller and push rod sliding in the guiding column M. One shaft, B (Fig. 3), projects from the crank case toward the front of the vehicle (the motor being placed under the bonnet over the front axle, as shown in Figs. 8 and 9,) and has a pin driven through it with both ends projecting. This is for use in starting the motor. The starting crank has a sort of bayonet socket slipping over the pin, which releases itself when the motor, gets an impulse. A relief cock is provided to ease the compression.

The governor is of the centrifugal type, and the governor balls act on a sleeve on the shaft, which sleeve is connected through suitable levers with a stepped wedge interposed between the exhaust valve stem J (Fig. 3), and the push rod which acts on it. Consequently the exhaust valve is opened for a longer or shorter period according to which step of the wedge is interposed, and the early closure of the valve at half load entraps a portion of the burned gases to dilute the fresh mixture. In addition an accelerator controlled by a pedal permits of varying the motor's speed from 300 to 900 revs. per minute.

Jump spark ignition is used, and there is one constant lead for regular running, which is reduced to zero when starting.

A vaporizer is used, and is shown in Fig. 5. The gasoline enters at A and fills the bulb B. A valve stem C carries a conical disc D, which has circular grooves cut in it and which nearly closes the passage E. At each suction stroke of the pistons this disc is lifted and the air, drawn in at G and passing through the holes shown, draws the gasoline with it. The gasoline, meeting and impeded by the circular grooves in D, is thoroughly broken up and mingled with the air, and a second or diluting air inlet, regulated by the operator, completes the mixture. A thumb screw and lock nut permit of adusting the lift of the valve D.

The water circulation is maintained by a centrifugal pump H (Fig. 8), driven by a belt from the pulley h on the motor shaft. From the pump the water goes to the radiator under the front of the bonnet, and thence it passes through the water jackets of the motor. Leaving the jackets it flows from a

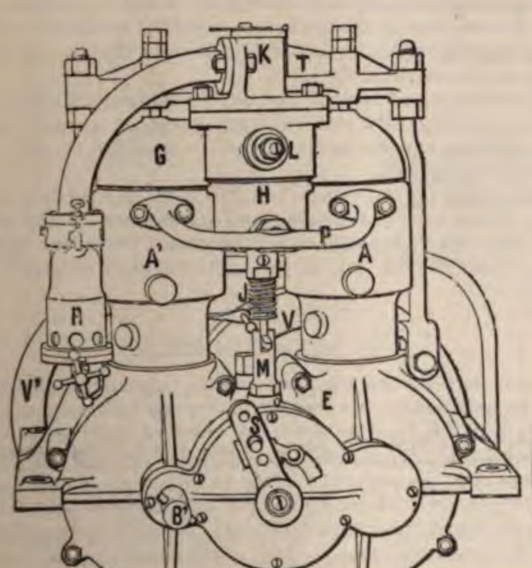


FIG. 3.—OUTSIDE VIEW OF MOTOR.

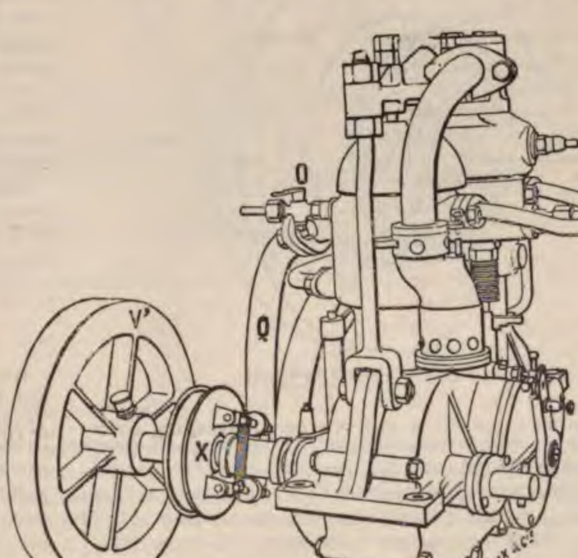


FIG. 4.—VIEW SHOWING GOVERNOR.

spout into a funnel J, so that its flow can at all times be observed; and from the funnel it passes by gravity to the tank. As the water does not boil its evaporation is trifling.

The friction clutch between the motor and the speed changing gears is shown in Fig. 6. A flange A on the fly wheel affords a friction surface on its inner face. A leather shod steel spring B, one end of which is fixed to a ring C, which is keyed to the ring C which is keyed to the intermediate shaft D, is so arranged as normally to press against the inner surface of A. The clutch is therefore normally in engagement, while nevertheless it can slip under a shock or excessive load. To release the clutch the sleeve E is made to slide along the shaft, actuated by a pedal under the left foot. This sleeve acts on a sort of wedge G, which in turn acts on a roller and the lever H to contract the spring B. The unclutching may be made gradual or immediate as required.

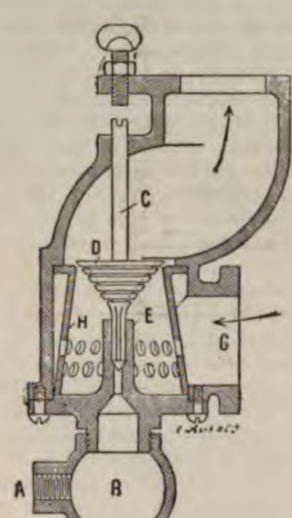



Fig. 5. Vaporizer.

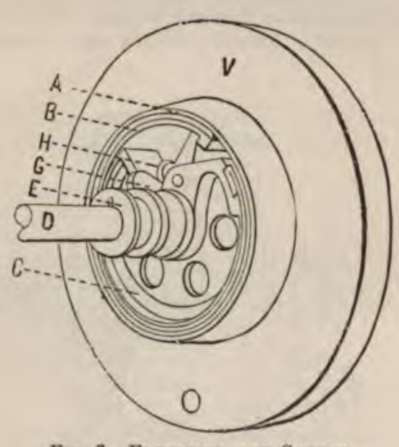



Fig. 6. Flywheel and Clutch.

Fig. 7 shows the speed-changing gear. Four forward speeds and one reverse are provided. B is the pinion on the intermediate shaft, acting on two bevel gears C, which turn loosely on the shaft D. A jaw clutch E, sliding on a squared portion of the shaft, establishes the connection between one or the other gear and the shaft. On this shaft are keyed four spur pinions for the different speeds, meshing with four gears, which turn loosely on the differential shaft G. Jaw clutches L and H, similar to E, connect these with quills on the shaft. K is the differential, whose drum is connected to the quills aforesaid, and the power is transmitted (Fig. 8) through sprocket chains to the rear wheels.

The jaw clutches L, E and H are shifted by forks and levers, broken away in the figure, whose upper ends carry rollers M, which work in circular cam grooves in a drum O. These grooves are so laid out that each position of the drum corresponds to the engagement of one speed clutch and only one. A pinion connects the drum with the speed changing lever. Only the slowest speed acts with the reverse gear. The whole mechanism is inclosed in a case A.

Steering is by an inclined wheel. The foot of the steering

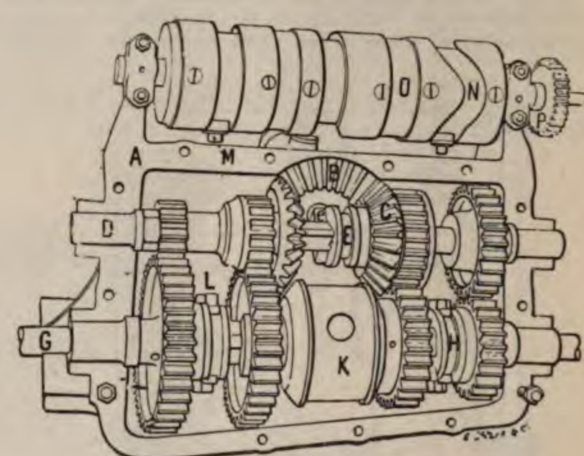



Fig. 7. Speed-Changing Gear.

tube carries a double-threaded screw engaging a toothed sector, which acts on the steering hubs by a lever and link. The hitch of the screw threads is such that the arrangement is nearly, but not quite, irreversible. This practically avoids fatiguing the operator and at the same time strains the steering gear less than if the mechanism were completely irreversible. About a turn and a half of the steering wheel throws the front wheels from one extreme position to the other.

Two powerful brakes are fitted: One, a pedal brake operated by the right foot acts on leather-lined bands on drums on the rear wheels. Before the brake is applied the motor is automatically disconnected. The second brake acts directly on the rea tires, and is operated by hand.

A ratchet wheel is provided on the differential shaft, and a pawl, normally held out of engagement by a small chain, is arranged to check any backward movement of the vehicle when going up hill.

The gauge of the vehicle is 1,250 mm. (49 inches), and the tread 1,600 mm. (64 inches,) and the bottom of the body is 650 mm. (26 inches) above the ground. The total weight is from 1,400 to 1,500 lbs, according to the style of body.

## ITALIAN PERILS.

Baron de Crawhez, the well-known Belgian chauffeur, who has toured nearly everywhere in Europe and even as far as Tunis and Algeria, does not think much of Italy as a country to travel through on a motor carriage. He made a trip in the early part of the year from Rome to Naples on a car which he had bought from Charron, and to which he had given the ill-omened name "Devastation." At Teresina a howling and malodorous mob broke the lock of the *remise* in which he had put his car and stole several things from it. "The same thing, only more so," at Gaeto, where the crowd nearly tore him to pieces.—*The Motor-Car Journal.*

## AN ENGLISH VIEW OF THE OUTLOOK FOR MOTOR TRACTION.

The advocates and promoters of automobile traction appear to think their difficulties will disappear when they have convinced the public of the advantages of the new system. We are afraid they will discover that their afflictions are then only commencing. The substitution of mechanical road transport for horse transport, and the greater distances for which it will be available, will disturb a number of present interests, and raise opposition, both commercial and political, which may cause serious trouble. It is because we believe the automobile car has come to stay, because we believe it is capable of rendering immense economic services to the trade of the country, that we desire to draw the attention of its friends to the obstacles they may have to encounter in the development of their ideas.

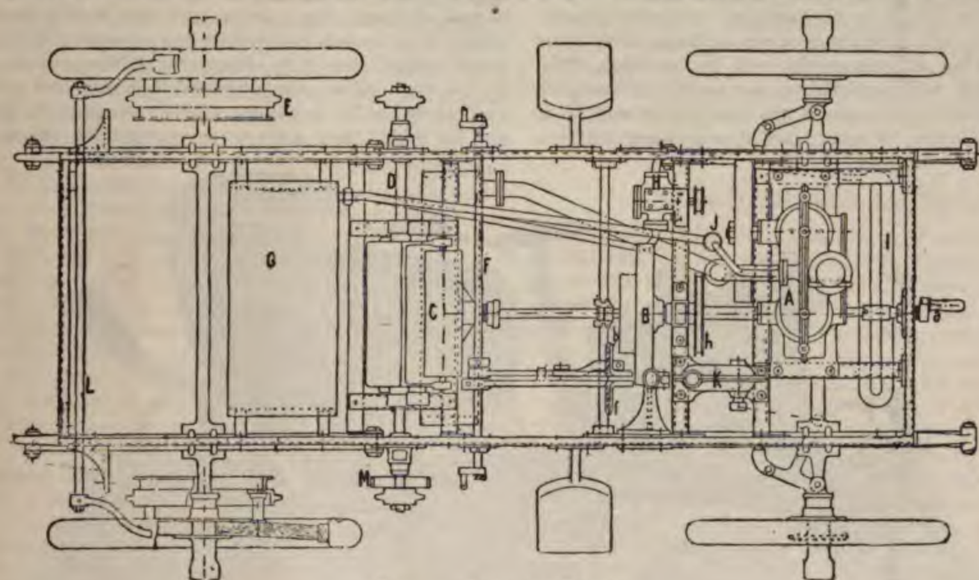



Fig. . Plan of Body.

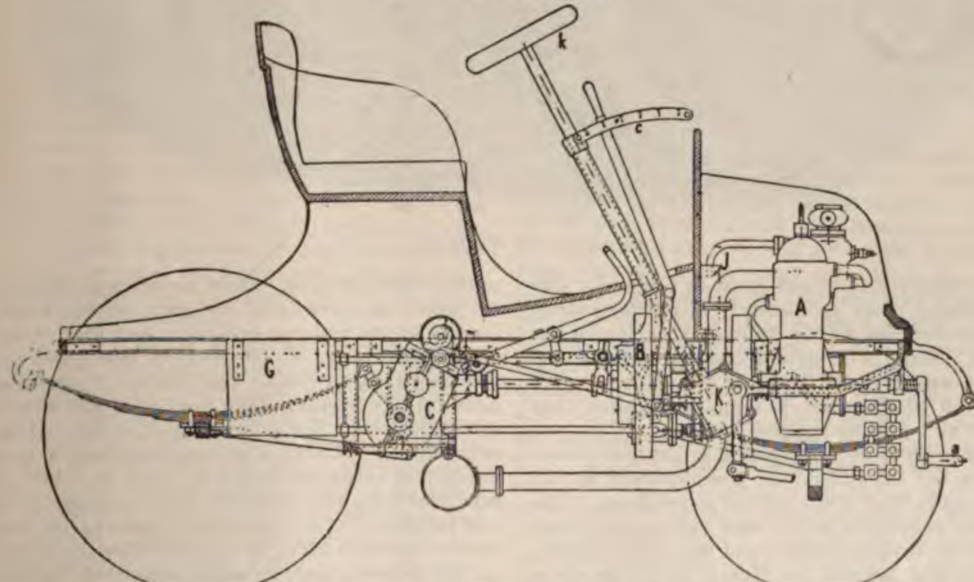
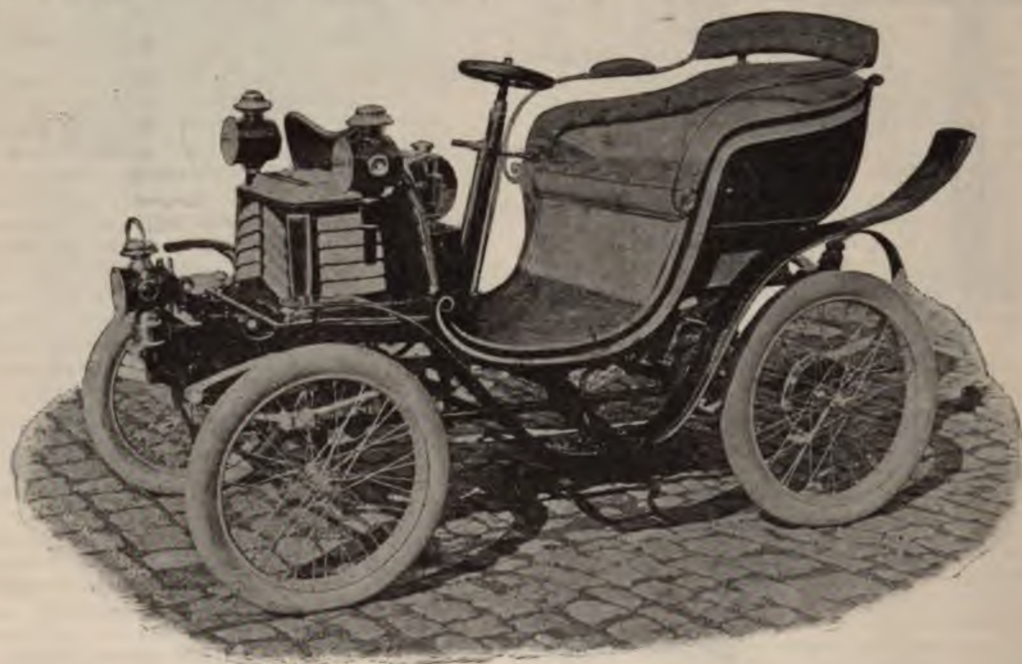



Fig. 9. Sectional Elevation.

It may reasonably be expected that the railway companies will be among the earlier patrons of the motor car. They are, at the present time, large employers of horse transport for collecting and delivering goods in all large centres of trade, and their expenditure on horse flesh is heavy; much heavier, in fact, than the general public would suppose. Railway managers are far too astute, and too eagerly on the watch for means to reduce working expenses, to neglect any opportunity which these cars may present of effecting economy. But the advantage they will thus gain will only be a temporary one, and they will be assisting to familiarize their clients with a formidable competitor to the iron road. It is not for such long distance traffic as London to Manchester, or Birmingham to Glasgow, that motor cars on ordinary highways may be expected to compete; but for a heavy and lucrative trade which has gradually been absorbed by the railroads, to the extinction of the old local carriers between neighboring towns. The Lancashire and Yorkshire system, for example, and the North-eastern and North Staffordshire systems in adjoining districts, are instances of the gradual extinction of the former pastoral method of heavy wagons and sturdy teams, and the substitution of mechanical transport on specially constructed roads.

The conditions which gave the railways their advantage will, however be altered in the new order of things. Between many of the places at present served by these lines—as, for instance, between Oldham and Manchester—it will be found more economical to load goods on a road carrier's motor wagon, which will convey them throughout from warehouse or mill to their destination, than to place them on a railway lurry for transport to the forwarding station, there to be transhipped to a rail wagon, and again transferred to a lurry for delivery on arrival at the station of destination. All the advantages will, for short-distance traffic, be on the side of the motor road carrier. There will be less handling of the goods, and, therefore, less labor cost and less liability to damage; while the annoying delays in delivery, which at times occur through overstrain of the railway carting arrangements, will be avoided. The very astuteness which will probably cause railway managers to adopt mechanical road traction in the near future will, at a later period, be employed to retard its development. There are many ways by which this object may be pursued. The companies are powerful, more particularly in parliamentary conflicts, and their conferences at the Railway Clearing House insure uniformity of action. The makers and users of the new cars must, therefore, watch the attitude of the railways with jealous solicitude, and be wary lest, in seeming to bless, they endeavor to hamper and destroy the new industry.

The greatest danger, however, to be feared is not the opposition of the railways, but the attitude of the popularly elected corporations and boards, and of the central government of the state. We need only point to a paper read before the Cincinnati May meeting of the American Society of Mechanical Engineers on "The Automobile Wagon for Heavy Duty," to show that this difficulty has already forced itself on the attention of automobile wagon builders. Mr. Herschmann there remarks: "It may be contended that the heavier weights supported by the largest types of motor wagons will damage the roads; but this can be proven to be a fallacy, since even if such damage did occur it would be more than outbalanced by the pounding and tearing action of the horses' hoofs." But he apparently overlooks the fact that these heavier weights will, in populous England at all events, be conveyed by motors over much longer distances than would be effected by the pounding and tearing of the horses' hoofs. In the one case the stress on the road would be for, say, 12 or 14 miles; in the other it would be for two miles only. If, therefore, we assume the damage to be equal for equal distances, the new conditions are likely to inflict much greater destruction on the total length of the highways. Nor is this all. The present "pounding and tearing" affects the terminal parishes only, but the new destruction by motor cars will also involve expense to the intermediate parishes. Oldham and Manchester, for instance, may not incur any greater charges for repairs of their streets through the transport of heavy traffic between those places being changed from the railways to the road. At the present time it is hauled by horses through the streets, and the motor car user of the streets will be compensated by the correspondingly less user by horse traffic. But it is altogether different with the parishes on the way. They are subjected to a new use of their streets and roads which is wholly additional to their present traffic, and for which they gain no compensation through decreased number of horse cars. These parishes or districts will, in fact, be providing a roadway for part of the work hitherto performed by the railway company, and they will, under present conditions, receive no payment or compensation for the facilities they thus provide. The heavier expenditure for maintenance of this portion of the road will undoubtedly be a charge upon the rates. Nor will the new burden fall equally upon all rate payers. The cry of greater incidence of taxation in rural as against urban districts will again be raised, and with more powerful voice than hitherto, since a greater number of electors will be affected. All this affords opportunity for a very pretty quarrel between rival local authorities, or a very close combination between them to mulct motor car owners.



The Antoine Voiture.

The latter method will probably be adopted, since the owners and users of cars are much fewer in number than the rate payers who will be affected by any increase in taxation. It is quite certain that, as between large centres of trade, the intermediate districts will suffer loss by the new mode of transport, and it has by no means yet been proved that the terminal districts will not also be prejudiced. The weight of the railway companies will also be thrown into the scale against the automobiles, and their influence will be more significant than at first sight appears. They are already large contributors to

the local rates. If their profits are reduced through any considerable portion of their goods traffic being abstracted to the highways, then they will seek to have their assessments reduced. The local authorities will thus be confronted with a double dilemma; with increased expenditure on their roads on the one hand, and a lowered valuation for revenue purposes on the other. Can there be any doubt that a democratically-elected assembly will be strongly tempted to solve the difficulty by imposing the dual loss on the people who have caused it?

There is yet another industry threatened, which of itself might be regarded without fear, but which has some interests in common with the larger municipalities, and would therefore join with them in placing difficulties in the way of development of the new motors. We refer to those farmers who depend for a considerable portion of their income on the breeding of cart or hack horses. The demand for hacks is already threatened by the rapid substitution of electric traction for horse trams, and an impotent bucolic outcry has only been averted by the South African War. The increase which must be made and maintained in mobile military forces may probably avert, for a time, the decreased demand and consequent lower price for suitable hacks; but eventually a market condition will arise which the horse breeder will certainly not welcome. The substitution of automobile carriages for the present hansoms and growlers will accelerate this condition, while the automobile wagon will more speedily bring it about for heavy cart horses. Thus the unfortunate farmer will find himself with one of his most important sources of income cut away at the very time that he is called upon for increased payments for the repairs of his roads. The farmers could easily be cajoled, or defied; but, unfortunately, the automobile carriage will threaten the prosperity of municipal tramways. Capable of any accommodation from two passengers to 40 or more—confined to no set routes, easily transferred from one portion of the town to another, as the exigencies of public requirements may demand —it seems destined to become a serious competitor with the Corporations' trading. It is a question of cost, and whenever an engine is invented which will be cheaper than tramway working as (it no doubt will be some day), the "pirate" cars and carriages will have the best of the race, unless they are handicapped by municipal taxes or regulations. And in this connection it must be remembered that the local authorities already possess a quasi-monopoly in the supply of electric power, which they are strenuously endeavoring to convert into an absolute monopoly. Should the ultimate motive power be electricity through the medium of accumulators, it is certain that the authorities will seek to prohibit the charging of such accumulators save at their own stations or from their own distributing mains. There are two dangers in this arrangement—the risk of excessive charges, and the probability of onerous regulations and unfriendly interference.

These are some of the breakers ahead against which the automobile makers and users have to guard, and it is really desirable they should early prepare to meet them. We do not consider the mechanical difficulties are by any means overcome; but each engineering improvement made will bring us nearer to the political and commercial obstruction which will assuredly arise. It is certain that the electrical industry was cabined and crippled by the first Lighting Act, and it is sometimes asserted that subsequent legislation has not altogether removed the disabilities then imposed. We do not desire to see this new trade crushed at home by Board of Trade regulations, while it increases and prospers in a freer atmosphere abroad; and it is in the hope of promoting the employment of home labor, and not in any spirit of carping criticism, that we venture to draw the attention of our readers to the subject—*The Mechanical Engineer.*

The Prince of Wales has become a convert to automobilism. His vehicle is a 6 h. p. Daimler mail phaeton, two-seated, with collapsible hood, crest, and *mecanicien* complete; and His Royal Highness is reported to be making satisfactory progress in mastering the levers, steering wheel, oil cans, etc.

## THE ANTOINE VOITURETTE.

The illustration given on the opposite page shows the light voiturette exhibited at the recent cycle and motor car show in Brussels by V. Antoine Fils & Co., of 43 Quai St. Leonard, Liège. The frame is of tubular construction, the body being comfortably suspended by plate and C-springs. The car is propelled by a single-cyclinder vertical motor, known as the "Kelecom," and rated at 4 e. h. p. It is fitted with electric ignition and water jacket, the latter extending around the combustion chamber as well as the cylinder. The engine is located in the fore part of the frame, under the bonnet, and is started by means of a detachable handle. Two speeds are provided, the power being transmitted direct to the rear axle. Steering is controlled by an inclined wheel, on the standard on which all the control levers are mounted. The wheels are of the cycle type, fitted with pneumatic tires. The car, which has a neat appearance, will, it is claimed, mount any ordinary hill.

## SPEED TRIALS IN BELGIUM.

Upon the Sunday, following the Gorden-Bennett International Cup race the Automobile Club of Belgium held a series of speed rials over a distance of one kilometre on the well-known Dieghem road at Brussels, when some remarkable times where achieved. In the category reserved for cars fitted with motors of more than 12 h. p., two of the racers specially built for the International event were competing, and as would naturally be expected, the greatest interest was manifested in their achievements. Belgian automobilists had been keenly disappointed by the non-starting of these cars in the cup race, for capital performances had been confidently anticipated from them; indeed, some of their more enthusiastic supporters had even expressed belief in an outright win for the Belgian colors. But the uncertainty as to whether the race would or would not be contested on the 14th instant seriously interfered with the arrangements of the Belgian contingent, and when upon the Tuesday afternoon previous to the *course* the international representatives decided to hold the race upon the originally selected date it was seen that Belgian's specially constructed cars would not be received in time to line up at the start. As a matter of fact the vehicles only arrived in Paris a few hours before the start of the race, and during that eventful Thursday they were resting tranquilly at the railway station. No wonder then that a goodly crowd of motor-men assembled last Sunday afternoon to witness these mighty racers go whizzing by upon the Dieghem road. Constructed on the Bolide system, these two cars are provided with 30-h. p. motors, and should their staying powers equal their pace they would certainly have run Charron and his Panhard pretty close in the cup contest. On Sunday last M. Jenatzy's mount made the kilometre, with flying start, in 38⅕ sec., which represents a speed of 94 kilometres, or 59 miles per hour. This is the fastest time ever officially recorded, the previous best being that made by M. Albert Lemaitre on his Peugeot during the Nice week of 1899. M. Lemaitre's time upon that occasion was 47⅗ sec., but it must be borne in mind that there are now in France several cars quite capable of greatly improving upon this figure. Take for example M. Levegh's performance in the Bordeaux-Perigueux event early this month, when he covered 116 kilometres in 81 min., which represents an average of 42 sec. for each kilometre throughout the journey. M. Jenatzy has now the proud distinction of holding the world's kilometre record with flying start on two types of cars, for, as is well known, it was he who drove the electric car "La Jamais Contente," over this distance in 34 secs. The second Bolide car was driven on Sunday by M. Lefebvre, and his time was 39⅗ secs., equaling a speed of 93 kilometres (57½ miles) per hour, also a splendid performance. In another category, that reserved for cars of eight to twelve horse-power, a capital run was made by a Gobron and Brillié, a vehicle which has hitherto not been regarded as particularly fast. This car made the kilometre in 58⅗ secs. equivalent to a

speed of 62 kilometres (39 miles) per hour. Coming to the steam cars, a record was achieved by M. Miesse's mount, which ran the distance in $48\frac{4}{5}$ secs., which represents a speed of 74 kilometres ($46\frac{1}{4}$ miles) per hour. The previous best was that made by a Serpollet car at Nice this spring, viz., $65\frac{3}{5}$ secs. The only other noteworthy performance was that achieved by the 6 h. p. voiturette of M. Guders, which covered the kilometre in $68\frac{2}{5}$ secs., or at a speed of 53 kilometres ($33\frac{1}{8}$ miles) per hour. In all the categories the majority of automobiles were of home manufacture, a striking testimony to the flourishing condition of the industry in Belgium and the quality of the vehicles constructed. The complete official returns were as follows:

MOTOR CYCLES.

| | | | Time in Seconds. | Speed per hour in Kilometres. |
|---|---|---|---|---|
| 1. | V. Dratz | $3\frac{1}{2}$ h.p. | $57\frac{4}{5}$ | 62 |
| 2. | De Ridder | $2\frac{3}{4}$ h.p. | 76 | 47 |
| | VOITURETTES PF MORE THAN 4 H. P. | | | |
| 1. | Guders | 6 h.p. | $68\frac{2}{5}$ | 53 |
| 2. | Liedekerke | 6 h.p. | $92\frac{3}{5}$ | 39 |
| | VOITURETTES OF LESS THAN 4 H. P. | | | |
| 1. | De Ridder | 3 h.p. | $73\frac{2}{5}$ | 49 |
| 2. | Madon | $3\frac{1}{2}$ h.p. | $73\frac{2}{5}$ | 49 |
| 3. | Dratz | $3\frac{1}{2}$ h.p. | $74\frac{1}{5}$ | 48 |
| 4. | Liedekerke | $3\frac{1}{2}$ h.p. | $95\frac{1}{5}$ | 37 |
| 5. | Delin | 3 h.p. | $108\frac{2}{5}$ | 33 |
| 6. | Moutens | $3\frac{1}{2}$ h.p. | $119\frac{1}{5}$ | 30 |
| | CARS OF LESS THAN 8 H. P. | | | |
| 1. | Riviére | 7 h.p. | 73 | 49 |
| 2. | Vanderspeck | 6 h.p. | $78\frac{1}{5}$ | 46 |
| 3. | Aubreby | 6 h.p. | $85\frac{3}{5}$ | 42 |
| 4. | Grègoire | 6 h.p. | $89\frac{1}{5}$ | 40 |
| | CARS OF FROM 8 TO 12 H. P. | | | |
| 1. | Roland | — | $58\frac{1}{5}$ | 62 |
| 2. | J. de Crawhez | 8 h.p. | $67\frac{3}{5}$ | 53 |
| 3. | Maus | 8 h.p | 101 | 35 |
| | CARS OF MORE THAN 12 H P. | | | |
| 1. | Jenatzy | 30 h.p. | $38\frac{1}{5}$ | 94 |
| 2. | Lefebvre | 30 h.p. | $39\frac{1}{5}$ | 92 |
| 3. | Wilford | 15 h.p. | $56\frac{1}{5}$ | 64 |
| 4. | P. de Crawhez | 12 h.p. | $63\frac{3}{5}$ | 57 |
| | STEAM CARS. | | | |
| 1. | Miesse | — | $48\frac{4}{5}$ | 74 |
| 2. | Blacke | — | $86\frac{3}{5}$ | 41 |

—*The Motor-Car Journal.*

## A 12 H. P. PANHARD CAR.

*The Engineer*, London, thus describes the two-seated Panhard-Levassor car of 12 h. p., which was run by the Hon. C. S. Rolls in the 1,000-mile trial and led the procession nearly throughout the route:

This car is of the phæton pattern, carries four persons, and weighs a ton. There are two pairs of twin-cylinder vertical engines arranged in front of the dashboard, longitudinally on the centre line of the carriage. Their speed can be varied from 500 to 1,300 revolutions per minute, and the carriage has four gears—10, 20, 30 and 40 miles an hour. Two kinds of ignition apparatus are provided to each cylinder—electric and incandescent tube. The electric current is derived from batteries. This dual arrangement minimizes the possibility of breakdown, owing to the failure of either ignition system, but the electric ignition also has another advantage, namely, that the speed of the engines can be controlled in a large measure by varying the time of ignition. The cranks are lubricated mechanically, and the cylinders are kept well oiled by splashes from the crank chamber. The change-speed gearing consists of four spur wheels, which can be moved longitudinally on a square shaft and transmit power to a second set of wheels which are secured on a parallel shaft. The latter in turn drives by means of bevel wheels the differential gear on the countershaft from which the power is transmitted by chains to sprockets secured to the driving wheels. The change-speed gearing is completely boxed in and runs in oil. The square shaft on which it is secured can be disconnected from the engine by means of a silent working clutch when changing from one speed to another. The carriage is provided with three powerful metal-to-metal band brakes, made in halves, hinged together and operated by an ingenious lever arrangement so that they act equally well whether the carriage is running forward or backward. On the recent run of the Automobile Club, one or two of the competitors would have appreciated a system of braking of this kind when climbing some of the steep hills. The wheels of the carriage are built of wood with a steel rim fitted with Michelin pneumatic tires. These tires, we are informed, behaved remarkably well on the 1,000-mile run, and were only punctured on one occasion. The steering is effected by means of a wheel secured to a shaft which operates through a worm and worm wheel, the usual Ackermann lever system on the front wheels of the carriage.

## AN OPINION ON THE MOTOR BICYCLE.

Apropos of the motor-bicycle "Criterium," organized by Le Velo, and run off on May 31, the correspondent of the *Motor-Car Journal* has this to say about motor bicycles in general:

In France the motor-bicycle, comparatively speaking, commands but little attention either from a racing or touring point of view. Here in Paris, where one sees daily some hundreds of automobiles, it is quite an event when a motor-bicycle passes, unless, of course, one is in the immediate vicinity of a firm manufacturing or trading in this class of machine. If people interested in their sale are to be believed, there are thousands of motor-bicycles ridden regularly in France, but these machines must be very rurally disposed, for one sees them seldom in inhabited spots. Personally, I am not surprised at this condition of things, which I account for rather by the timidity of the rider than the bashful modesty of the machine. But perhaps I should not say timidity, for it requires more than an ordinary stock of courage to ride a motor-bicycle through crowded streets after a shower of rain. Oh! those side slips, so cunningly conceived and skillfully executed by this innocent-looking little machine! I do not deny that a run on a motor-bicycle over country roads is a delightful experience, but if one has to descend and push a 70 or 80-pound machine through the more crowded streets of every town encountered en route, I for one do not think that it is good enough, and would prefer to pay another £40 and buy a tricycle. Such as it is, however, some progress has been made in the machine's construction, and the motor-bicycle of to-day is a long way ahead of that in use a couple of years ago.

## MATCH THIS.

A few weeks ago *The Scottish Cyclist* drew attention to the disgraceful state of that portion of the coast road between Musselburg and Levenhall, and urged that another effort should be made to get the local authorities to perform their obvious duty. Quick to take a hint, the honorary secretary of the Lothians District Association of the C. T. C. duly wrote to the Musselburg Town Council requesting that the macadamized sides of the road be put in order. He further suggested that an improvement would be the sweeping off daily of the loose stones. The matter came up at the monthly meeting of the Council held on Tuesday evening, 12th inst. Councilor Kitto moved that the letter be allowed to lie on the table. He thought the letter a gross piece of impertinence. The cyclists were not rate payers. Bailie Bisset seconded. Councilor Hogg moved that they put the road in order. It was dangerous to cyclists. He had seen men carried in insensible as the result of cycling accidents there. Treasurer Simpson seconded the motion to tidy up the road. Bailie Bisset objected to being browbeaten by what he considered a public nuisance, and thought it would be well if the Council could push the cyclists round by Dalkeith. The cyclists could not get better roads. That was what brought them there. After further discussion it was agreed to repair the road.—*The Scottish Cyclist.*

## THE FASCINATION OF AUTOMOBILING.

The London *Spectator* has this to say about the charm of motor vehicle driving and why it may be expected to endure:

The essential and controlling charm of the horseless carriage

is that it increases one's freedom of action and reduces the friction of life. A metaphysician might describe it as forming part of a reaction toward individualism and simplicity of action engendered by the temporary triumph of collectivism as applied to transport. The railway train is necessarily collectivist. A passenger train starts and reaches its destination owing to the combined volition of a large number of people who went to travel from, let us say, Bath to London, or between places along the Great Western Railway. But in order to satisfy those volitions and make them executive they have to be marshalled and organized, and so in a sense shackled. A railway train, with its guards and drivers, and fixed places of stoppage, is a creature of strict rules, and those who travel in it must temporarily surrender their private wishes, or a part of them, in order to co-operate with others. The man who takes out his motor car and drives it along the road is, as it were, a freeholder, with all the freeholder's freedom—though, doubtless, also with some of the freeholder's limitations and weakness and isolation. Still, the charm of freedom remains, and allows him to start when he likes, stop when he likes, and be independent of his fellows. This charm, of course, belongs also in theory to any carriage from donkey cart to a landau, but in practice it does not operate in such cases except over very short distances. The lust of time-saving is too powerful and gives the advantage to the train. No horse can go at the rate of 12 miles an hour for three consecutive hours, and at the end of the three hours be ready and able to go on for another three or eight or ten hours. It is its tirelessness which makes the motor car quite a different mode of transport from a horse and gives it its superiority. In the case of a motor car you have a method of moving from place to place as tireless as a train, one which for short journeys and cross journeys is as quick as the train and yet one which is individualistic and independent.

## SOME POWERFUL GAS ENGINES.

In a recent issue of *Stahl und Eisen* Herr Muenzel gives a complete historical account of the development of the large power gas engine, and among other plants in use he describes the Central Station of Horde. There are here two groups of gas motors of 600 h. p. each; each group includes two gas engines coupled directly to an alternator. In the Central Station of Friendenhutte, at Morgenroth, furnace gas is utilized to produce power and electric light; and there are six motors of 300 h. p. coupled directly to alternators, and two motors of 200 h. p. coupled directly to a dynamo. A gas generator, sufficiently large to produce a force of 2,000 h. p., has been installed near by in case the supply from the furnaces should be insufficient. The Central Station at Basle, Switzerland, has three motors, of 300 h. p. each, fed by gas from a coke furnace; the output of power is said to be equal to 0.93 kilowatt for one kilogram of coke.

## MUNICH OPEN FOR MOTOR VEHICLES.

Consul Worman writes from Munich:

"The Bavarian Government has just set aside the city ordinance preventing the use of automobiles on the streets of Munich. This opens up one of the best German cities for American manufacturers of horseless vehicles of every sort, and wide-awake agents should be promptly sent to this field so promising, because of the large class of wealthy residents.

"Munich is the third largest city in the German Empire. The streets are well paved, bicycles are popular and horses dear. This opening should not long be neglected by American enterprise."

E. W. Roberts, author of "The Gas Engine Handbook," and a recognized authority on gas engine topics, expresses in the current issue of *Machinery* a belief that electric ignition is destined to supplant entirely the hot tube method of firing the charge.

## MINOR MENTION

The Buffalo Automobile Club has been organized. The first club run will take place Sept. 4, and a parade is talked of.

The Foye Hub Motor and Automobile Co., Jersey City, has been incorporated under New Jersey laws. Capital $200,000.

An automobile race from Warren, O., to Conneaut Lake, will be a feature of the Warren Merchants' picnic at Conneaut Lake, July 25.

Hartford, Conn., is to give motor tricycle mail collectors a trial. These tricycles are built by the electric vehicle Co. at their Hartford factory, and carry an operator and a collector.

Fire Chief Edward Croker, of New York City, has a fast locomobile for use in fire duty. It is expected to shorten considerably the time required to reach fires occurring some distance from headquarters.

A company is being formed in Plainfield, N. J., to operate motor stages on the residential streets of that city. It is estimated that the route will be covered in 30 minutes, and a 10-cent fare will be charged.

Messrs. Lamplugh and Co., Limited, is the name of a company which has just been registered with a capital of £10,000, to carry on the business of cycle and motor saddle and accessory manufactures, etc.

The statements of Examiner of Stationary Engineers Lawler, of Buffalo, regarding licenses for motor carriages, have been explained. It appears that Mr. Lawler said only that drivers of steam carriages would require licenses.

Negotiations are in progress to place a large number of motor stages on the streets of St. Louis. It is reported that these stages will carry 30 passengers each, and that they will have the same gauge as the trolley cars, so that they can run on the rails if desired.

There were 39 motor carriages in line in Bridgeport's automobile parade on July 4. The silver loving cup offered by Mr. Griffin for the best decorated carriage was won by the Misses Emma G. Riker and A. M. Kennedy, of Bridgeport, who drove a locomobile.

Oliver Lippincott, an artist of Los Angeles, and E. Russell of the same city, recently rode into the Yosemite Valley on the first motor vehicle to enter that famous spot. It was a steam carriage, and it easily made eight miles an hour on grades where the regular Yosemite stages can cover only three.

The new ordinance requiring steam automobile drivers to have local licenses has caused a great deal of trouble to New Yorkers who pass through Yonkers. At a recent meeting of the Police Board it was decided to modify the order so that any one presenting a certificate from some other municipality in the state may pass through Yonkers on that certificate.

The Kensington Automobile Mfg. Co., recently incorporated in Buffalo with a capital of $600,000, has purchased the plant and factory of the Kensington Bicycle Mfg. Co., and will build a three-story brick addition, 200x40 feet. The factory will be equipped with all the most modern machinery for the manufacture of steam and electric vehicles, and it is intended to employ about 500 men. The following officers have been elected: President, W. J. Knowles; vice-president, J. A. Roberts; secretary, J. J. Gibson; treasurer, C. G. Shepard.

Bridgeport, Conn., is considering an ordinance restricting the speed of motor vehicles to seven miles an hour within a radius of one mile from the railorad station. No fault is found with the manner in which employes of the Locomobile Co. of America operate its vehicles, but the proposed ordinance is designed rather to protect the public from inexperienced operators.

The matter of toll charges is being agitated in the columns of *The Motor-Car Journal*. It appears that certain toll-gate keepers make a practice of charging exorbitant rates where they can, by classing motor carriages as traction engines, etc., and by levying toll on the return trip of a carriage. One correspondent of our contemporary paid 1s. 6d. each way, or a total of 75 cents, for the privilege of going across a bridge and returning the same day!

Charges of blackmail have been made by John W. Eisenhuth, President of the Eisenhuth Horseless Vehicle Co., of New York City, against James Wilson, Edwin C. Talcott, Stuart H. Chisholm, and Daniel R. Hendricks, directors in the company, and the case is now being tried in court.

On or about April 25th last the four defendants caused Eisenhuths' arrest on the charge of obtaining money on false pretenses. The May Grand Jury failed to indict him, and the present charges were made by him on his liberation.

The 600-mile tour of the three Cleveland automobilists, F. L. Strong, W. S. Root and C. S. Ingalls, through Canada from Buffalo to Detroit, was an entirely successful one, with no break-down or hitch of any kind. Much of it lay through country where motor carriages were as yet unknown, and the rural population derived much excitement from the event. Even the village schools suspended session while the unaccustomed machines went by. The longest day's run was from London to Detroit, 105 miles, which were covered in 11 hours, including stops.

An automobile company, with headquarters in New York, is arranging through a representative, Mr. Charles Decker, to place 500 automobiles on St. Louis streets. Offices have been opened there to take subscriptions toward the formation of a local company. Operations will begin as soon as the first vehicles arrive. The capacity of the vehicles will be 30 passengers. They will be built so as to run on the tracks of the street car companies. Each vehicle will cost $2,000. The company will be incorporated and if objections are raised to operating the vehicles on the street they will be sold to individuals.

The Metropolitan R. R. Co., of Washington, has installed a battery-propelled repair wagon for its trolley cars to take the place of the horse-drawn wagons till recently in use. It was found that the cost of keeping the horses was out of all proportion to the service they rendered. The wagon will accommodate 15 men and the necessary tools. It is provided with a huge A ladder, so that repairs to the trolley and supporting wires may easily be made. In proceeding to the scene of the break the wagon is not compelled to follow behind the route of the slower moving passenger cars, the saving in time from this feature alone being considerable. The vehicle complete weighs about three and a half tons. A towing device for replacing derailed cars or taking a disabled car to the repair shop is provided. The storage battery is good for 25 miles at an average speed rate of 14 miles an hour.

The Locomobile Co. of America has purchased a large tract of land at Bridgeport, Conn., and is to build a large factory there. The officers are divided in their opinions as to whether the entire business shall be assembled at Bridgeport. The company has a large plant in Worcester, in the Speirs Manufacturing Co.'s building, besides the Spiers drop forging plant. There is another plant at Westobro, and still another at Bridgeport. Some of the directors believe it better to maintain the Worcester plants, at least. In case of fire or strike the eggs would not be all in the same basket. Others maintain it would be economical to assemble the entire business in the new shop.

The contract for the new buildings at Bridgeport has been let, with orders to hurry the work.

The Locomobile Co. has a one year's lease of the Spiers Building, with the privilege of purchasing at the end of that period. The drop forging plant it already owns, as it does the property at Westboro.

## REVISE THE STATUTE.

Residents of Newport and Narragansett will not be allowed to transport automobiles operated by gasoline on American ferry boats.

Supervising Inspector General Dumont has decided that automobiles operated by gasoline engines cannot be carried by freight or passenger steamships. This decision was made upon inquiry by the Jamestown and Newport Ferry Company.

Mr. Dumont decides that section 4,472 of the Revised Statutes absolutely prohibits the ferriage of naphtha, benzine, etc., under any circumstances on either freight or passenger steamships, which includes ferry boats, and therefore would prohibit gasoline automobiles when their tanks are supplied with gasoline.

## A RECORD FROM BOSTON TO LEWISTON.

Francis E. Stanley, accompanied by his wife, son and daughter, made a quick trip from Newton, Mass., to Lewiston, Me., on June 30. Leaving Newton at 4 o'clock in the morning they reached Portland at 12 o'clock, having made two stops aggregating one hour. The road was rough and heavy, and a very strong head wind was blowing. The actual running time was seven hours, and the cyclometer showed that they had traveled 128 miles.

The party left Portland at 2:45 p. m., and arrived in Lewiston at 4:45, the cyclometer showing a distance of 33 7-10 miles, for which the running time was two hours. The total distance traveled from Newton to this city was 161 7-10 miles, and the total running time was nine hours, making the average nearly 18 miles per hour.

## RECENT PUBLICATIONS.

"Horseless Vehicles, Automobiles, Motor Cycles, Operated by Steam, Hydro-Carbon, Electric and Pneumatic Motors," by Gardner D. Hiscox, New York, Norman W. Henley & Co. 459 pages. Price, $3.

Beginning with a short historical chapter on the early English attempts at road locomotion, the bulk of this book is an industrious compilation from the catalogues of motor vehicle builders and from trade and technical publications, with the first-named source of information preponderating. Separate chapters are given to steam vehicles, gasoline motors transmission gears, gasoline vehicles and motocycles, electric vehicles and accessories, and a number of vehicles of each type are selected for illustration In some cases useful data as to dimensions, etc., are given. The scope of the volume extends from traction engines to patent lubricators, and American manufacturers get decidedly the lion's' share. Such builders as Panhard and Levassor, Peugeot and Mors are not even mentioned, and the Daimler vehicle is represented only by its vaporizer! The "Locomobile" has a fairly complete description, but many vehicles and motors seem to be put in or left out by pure caprice. The chapters on electric vehicles are the most nearly satisfactory; but the inventor or constructor who takes up this book in the hope of finding technical guidance will be sadly disappointed. A list of United States motor vehicle patents ends the book.

Motor-car excursions in Paris and district are now being organized by a concern known as L'Auto-Touriste, of Levallois-Perret.

# MOTOR VEHICLE PATENTS
# ∴ ∴ OF THE WORLD ∴ ∴

## UNITED STATES PATENTS.

652,104—Combustion Engine Starting and Reversing Device. —E. S. Haines, of Jacksonville, Fla. June 19, 1900. Application filed March 22, 1899.

A rather intricate device with special igniters for producing a spark at other than the regular times.

652,275—Interchangeable Gear Driving Mechanism for Motor Vehicles, etc.—August Krastin, of Cleveland, O., assignor of one-third to J. George Schnuerer, of same place. June 26, 1900. Application filed Sept. 18, 1899.

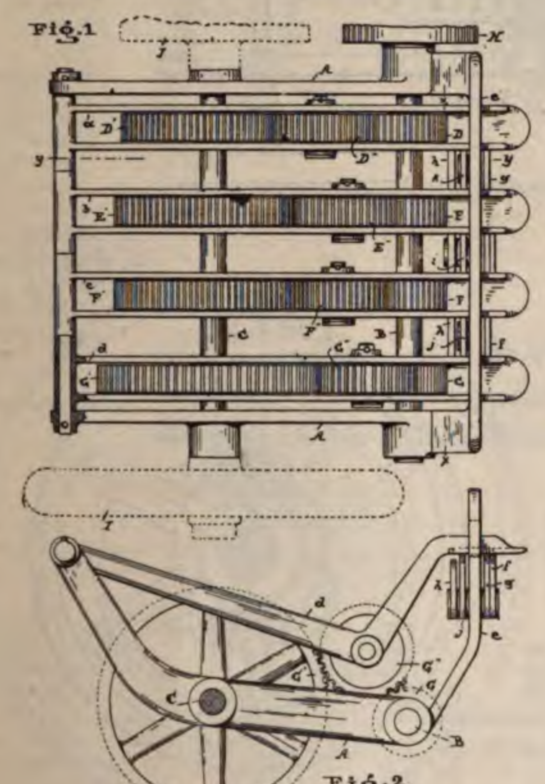


Fig. 1 Fig. 2.

This mechanism is of the class wherein different sets of gears are engaged or disengaged by being moved toward each other in their own plane, instead of being shifted axially along their shafts. Fig. 1 shows a plan of such a mechanism, wherein B is the motor shaft and C the axle, and four speed changes are provided for. As shown in Fig. 2, the intermediate pinions G″, F″, E″, D″ are mounted each on an independent lever, having a toe at its right hand end to elevate or depress it to bring the pinion into engagement. In conjunction with these levers is employed a system of idle levers, seen in Figs. 3 and 4, so disposed that when the toe of one of the pinion carrying levers is depressed all the other levers are thereby pushed up, carrying their pinions out of engagement.

652,278—Motor Vehicle.—F. A. La Roche, of New York, N. Y. June 26, 1900. Application filed March 2, 1900.

This invention relates to vehicles propelled by what are known as "combination systems," having a gas engine for primary motive power and a dynamo and set of storage batteries to act as an accumulator of power. On level roads the dynamo absorbs a portion of the engine's power and on down grades, with the engine shut off it acts as a brake, in each charging the batteries. On up grades or heavy roads it acts as a motor drawing its current from the batteries.

In the figure, 1 is the engine, which is shown as having three cylinders radially spaced about a central crank shaft; 51 is the armature of the dynamo, revolving outside of the field magnets and acting as a flywheel; and 24 and 37 are sprocket chains for two speeds. The clutch thimbles, 33 34, by which one or the other of these speeds is obtained, are operated by one lever, 31 32, pivoted at 30, and so arranged that the slow speed clutch is engaged first. The thimbles are made in the form of double cones, and after the first or slow speed clutch has been engaged, a further movement of the lever carries it beyond the engaging point, so that the dog, 21, slips into the hollow 33, thus releasing this clutch, and the high-speed clutch is then engaged.

Band brakes are provided at 40 and 45, on the rear axle and the counter shaft. No compensating gear is shown. The motor is series-wound, and its polarity is reversed (to convert it into a dynamo) by reversing the current in the field magnets by a hand-operated switch. The change is, therefore, not automatic. There are 24 claims, covering the various combinations and the details.

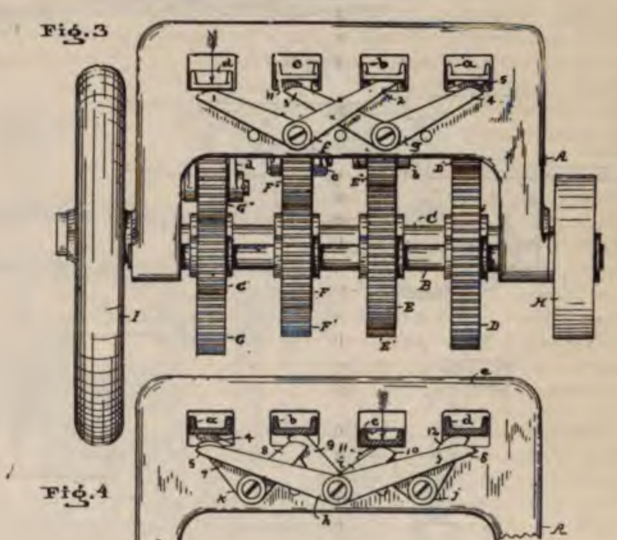


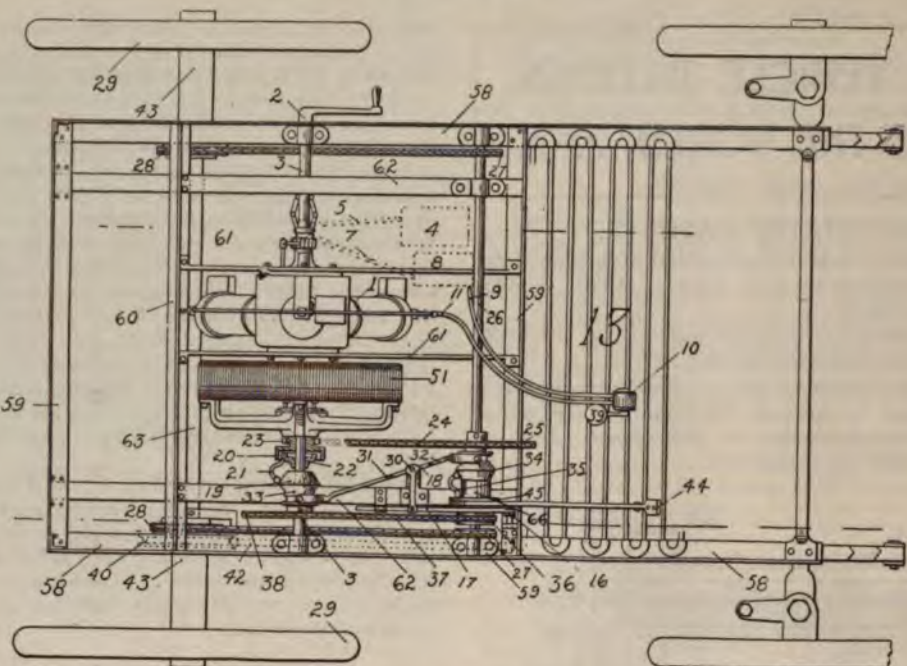
Fig. 3 Fig. 4

652,470—Explosive Engine.—Thos. Cascaden, Jr., and T. C. Menges, of Waterloo, Ia., assignors to the Davis Gasoline Engine Works Co., of same place. June 26, 1900. Application filed July 13, 1899.

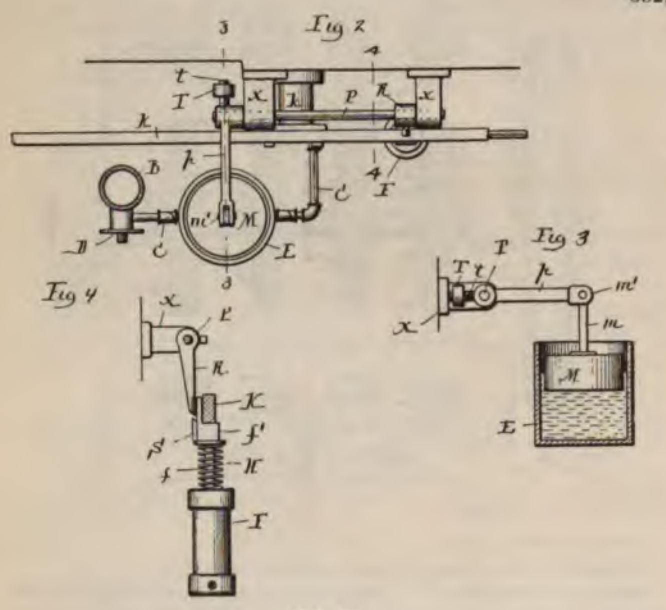
This invention relates to gasoline engines in which the gasoline is fed by a pump, and the invention consists in a means for controling the pump's action according to the level of gasoline in a float tank through which it passes on its way to the cylinder of the engine.

In Fig. 2 is shown a plan of the mechanism involved, while Fig. 3 is a detail of the float tank, and Fig. 4 a detail of the pump. The lever K is pivoted at k and rocked vertically by a cam and roller. In doing this it acts on the plunger of the pump, which is returned after each down stroke by the helical spring. The float M acts on a rocking shaft P, to which is made fast the pawl R; and when the float rises beyond the assigned level the pawl engages with the knife edge S and the plunger is held down till the gasoline level falls once more.

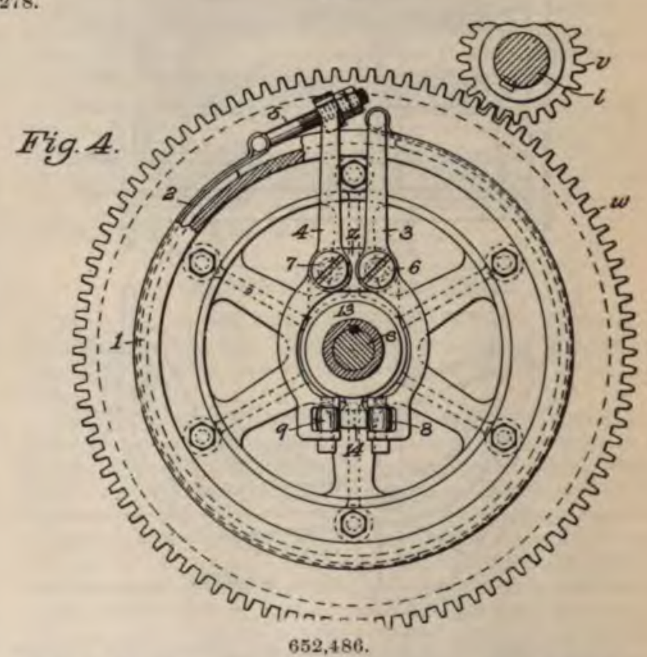
652,486—Motor Vehicle.—R. M. Owen of Cleveland, O. June 26, 1900. Application filed Dec. 19, 1899.



652,278.




652,470.




652,486.

The principal feature of this invention is the arrangement of the transmission gearing, which is shown in Figs. 1 and 3. In these, l is the motor shaft and suspended from it by rods o and p and braced to the rear axle by adjustable struts q and r is a countershaft s, on which is secured the sprocket wheel which drives the rear axle. The rods o and p and the struts q and r have loose bearings at both ends, so that the frame may be free to rise and fall somewhat in relation to the axles.

Mounted on the motor shaft is the pinion v and a larger gear x meshing with the gears w and y, which are free to turn on the countershaft. Attached to these gears are friction rings which are clutched to the shafts by the operation of wedges 14 and 15. These wedges act on levers 3, 4 (Fig. 4), spreading their short ends and tightening the bands surrounding the friction rings. It will be understood that the spiders 2 and 12, on which the levers 3 and 4 are mounted, are keyed to the shaft, and that the sleeve 13, which carries the wedges, is made to slide on a feather and revolve with the shaft.

The reversing mechanism is shown in connection with the high speed gear, though this is not essential. An arm 18, keyed to the countershaft, carries a shaft 17, on which are keyed gear 19 and pinion 20. The former of these engages a pinion 16, which is fast to gear y and is free to revolve on the shaft. Pinion 20 engages a gear 21, which is attached to a friction ring 22, which can be arrested from revolving by a clutch arrangement similar to those just described, but operated from without. Consequently, when gear 21 is held from revolving, pinion 20 is forced to travel around on it, planetary fashion, carrying with it the shaft 17, arm 18 and the countershaft, all in the opposite direction to that imparted by the other gears.

652,541—Reversing and Speed Changing Gear.—C. A. Gour-

*Fig. 1.*

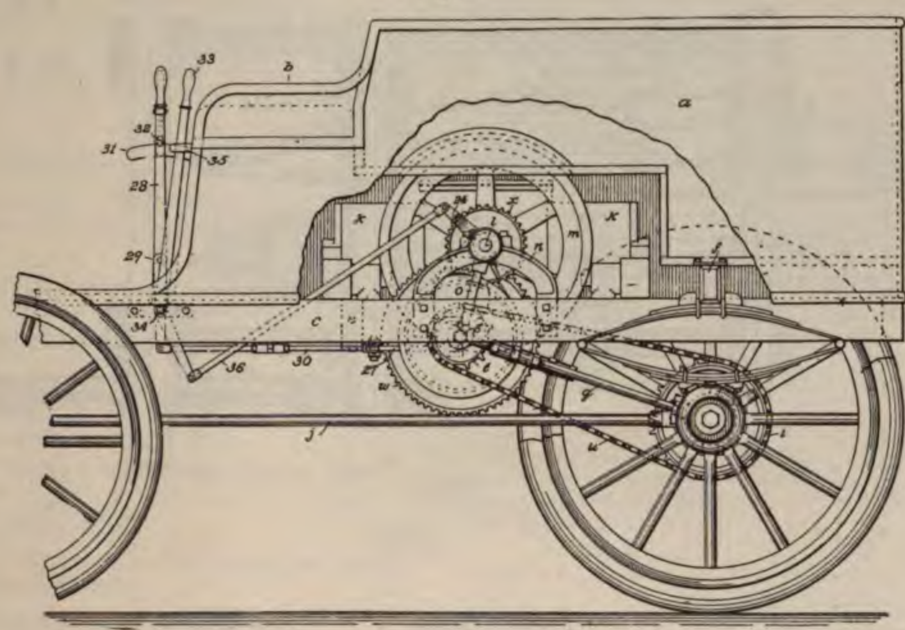
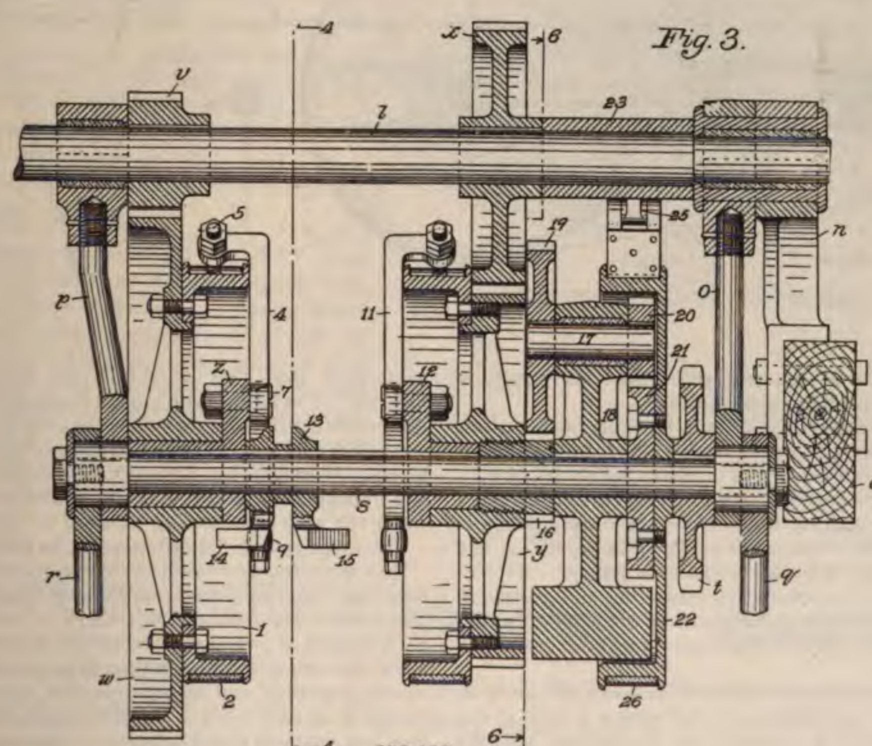


*Fig. 3.*

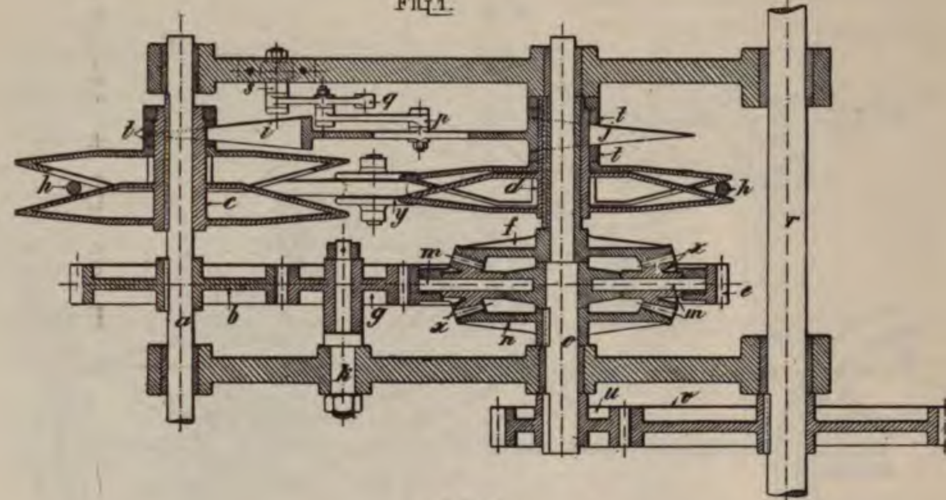


652,486

goulin and A. H. Croizier, of Paris, France. June 26, 1900. Application filed March 6, 1900.

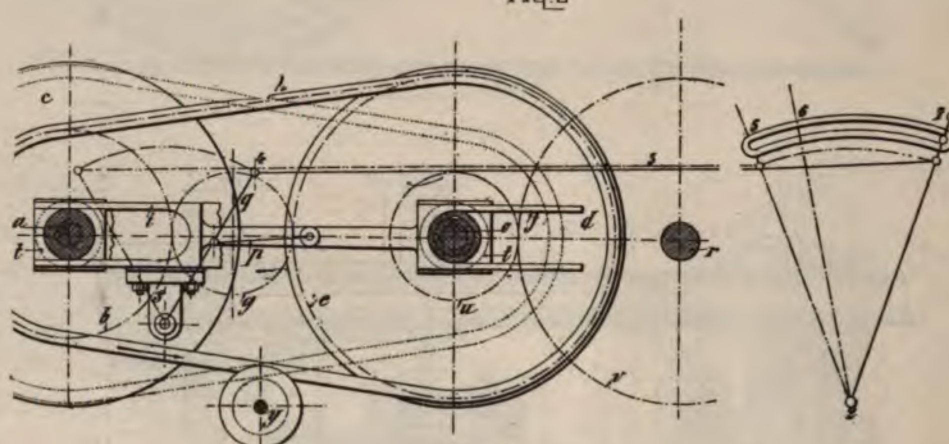
This is a novel and highly ingenious application of the principle of the differential gear to speed changing mechanism. It is well known that if the drum and pinions of the differential gear or "jack-in-the-box" be rotated by power, and one of the bevel gears be retarded in its rotation, the other bevel gear will rotate at a speed correspondingly greater than that of the drum. Most of the devices proposed for utilizing this principle, however, involve the use of a brake for retarding the first bevel gear; and this means the waste of just so much power. In the present invention, however, the shaft of the first bevel gear is belted to the motor shaft through expansible pulleys, so as to run at the velocity determined by the ratio of those pulleys; and thus no power is lost. Again, by making the first bevel gear rotate faster than the drum, the second bevel gear will

FIG.1.



652,541.

FIG.2



652,541.

have its direction of rotation reversed; and this again is accomplished by the same expansible pulleys.

In the drawings a is the motor shaft, v the axle, and xx are pinions mounted in the differential drum, which latter carries the gear teeth e on its periphery and is free to rotate loosely on shaft o. Bevel gear n is keyed to shaft o, while the bevel gear f has a sleeve, integral with its hub, on which is keyed the expansible pulley a. The expansible pulley c is keyed on the motor shaft, and a belt h connects the two pulleys. As will be seen, the pulleys have alternately intersecting radial fingers on their coned working faces, and are shifted for different speed ratios by the wedges i j, working in loose blocks or collars as shown.

The pulleys are shown set for the slowest speed of pulley d, which is therefore the maximum speed of pulley n and of the motor. When the gear f is rotating at double the angular velocity of the gear e, the gear n will not rotate at all, and this velocity of the gear f and pulley d corresponds to the vehicle's position of rest. If now the speed of the pulleys be varied to increase still further of d and f (the speed of e remaining constant), the gear n will begin to rotate in an inverse sense, and the vehicle's motion will be reversed.

It is evident that the load on the teeth of the gear f will always equal that on the gear n, the difference in the power transmitted by them being merely one of velocity and not of load. The expansible pulleys and the belts, therefore, carry the same load that they would if they transmitted the power directly. The advantage gained from the incorporation of the differential, is that by its means the vehicle can be reversed without shock and without the addition of special mechanism and levers. If desired, the belt may be used as a brake by shifting the pulleys into what may be called the reversing position when the vehicle is running forward or vice versa.

The claim is very limited, reading as follows:

In a reversing and speed-changing gear for vehicles, automobiles and other applications, the combination of a differential mechanism comprising two pulleys of variable diameter, and each formed of two cheeks, relatively movable one to the other, with connected wedges acting to separate or move the said cheeks together, and singly-operated means operatively connected with said wedges for giving the driven part a progressive and variable speed forward or backward, such speed being confined between two predetermined limits, substantially as set forth.

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## Volume I, No. 1.

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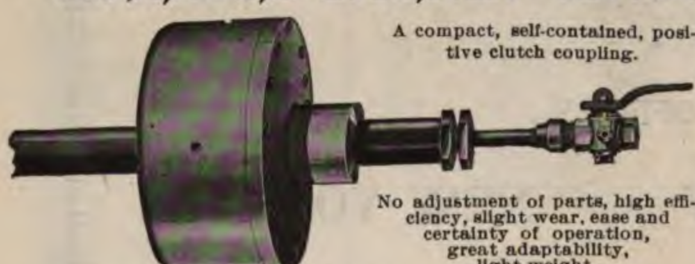

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BY ISAIAH L. ROBERTS.

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VOLUME VI | NEW YORK, JULY 18, 1900 | NUMBER 16

# THE HORSELESS AGE.

E. P. INGERSOLL, EDITOR AND PROPRIETOR.

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## A MACHINE AND ITS LESSON.

IN a recent issue of *La Locomotion Automobile* Gaston Sencier draws a moral from the design of the racing machine built by the Nesseldorfer Wagenbau-Fabriks-Gesellschaft, which was illustrated in THE HORSELESS AGE of July 4th. The builders of this machine, in describing it, laid stress on the fact that they had discarded all endeavor to imitate the form of a carriage, and, frankly recognizing the essentially mechanical character of their production, had worked with the single object of adapting it as perfectly as possible to the end in view. "They are perhaps," says the writer above mentioned, "the first in our industry to claim the merit of understanding that an automobile is not a carriage, that there is a total dissimilarity between the two, and that the former has no more excuse for imitating a horse vehicle than there is for a locomotive being built to resemble a horse or a railway car like the old diligences of a bygone age.

"I know very well," M. Sencier continues, "that in saying so I run foul of preconceived ideas. But let those who profess these retrograde views give me one serious argument in their behalf and I will listen to them. They have no argument at all, but the single one of public prejudice and accepted custom.

"It follows that the Austrian builders argue like men of good sense. They put before themselves a program. We desire, say they, a vehicle carrying so many men, able to cover so many kilometers without replenishment of gasoline and water, and able to attain without danger a mean speed of so many kilometres an hour. That is the whole matter. It is a mechanical problem to be solved. They have attacked it, and now present a first approximate solution.

"It is for that that I congratulate them. The automobile industry has up to the present followed the common law of all new industries: it has been the slave of many prejudices and no less errors. It is by no means singular in this. Look at the old prints of the first railway trains built in England and France. The cars are almost copies of diligences, and the spirit of imitation extends even to the placing of a conductor on a special seat in each car. To-day the railway car is approaching its final form as seen in the modern express trains. *Au diable la diligence!* The cars are no longer made to satisfy the demands of a pretended æstheticism in imitating a bygone style. They have, therefore, found their true excellence of form. As to the locomotives, no one attempts to make them pretty, but solely to design all their parts for the work that they have to do. In spite of that, even they have gained a beauty which they never had before. It is the beauty of the machine built for speed, of the flyers of the Northern and the Eastern Railways, the thoroughbreds of the rail.

"I hope that some time even our automobiles will reach this point, and the first essential to this end is to make *tabula rasa* of our prejudices, and to understand finally that an automobile is a machine."

Before dealing out exemplary condemnation on the courageous author of the above words, it is fair to remember that he is writing of racing machines only—machines whose sole purpose is "to go at such a speed for such a distance with so many passengers." It is not in the least likely that M. Sencier would elect the Austrian machine referred to for a provincial tour with his family, or would recommend it to others for that use. Nor is it probable that he or any other *chauffeur* would select the obtrusively mechanical mount in preference to a light

voiturette for a spin about the parks and under the suspicious eye of the gendarmerie.

But the author's real contention is sound. A vehicle, for whatever purpose, should be designed with reference to that purpose and to nothing else. In proportion to its fitness for its purpose does it satisfy the canons of true good taste. In proportion as it forsakes the intent of its use in pursuit of preconceived notions of what it ought to look like, of untutored ideas of prettiness or "shape," just so surely will the advance of enlightenment leave it a laughing-stock. The horse vehicle, in its many forms, is perfectly adapted to its use, and no one would wish to change it. Comfort, safety and speed are alike required of the modern railway coach, and each is provided for in full measure. And what man, in whose breast the "Song of Steam" ever awoke an echo, has looked up at the huge iron steeds that hurry the Empire State Express and the Atlantic City Flyer over the rails, at speeds unmatched in railway engineering, without a quicker pulse-beat for the tremendous harnessed force which speaks in every line?

The automobile is peculiar in that it must be locomotive and car in one, and neither function should be slighted or concealed to the enhancement of the other. In this respect it most nearly resembles the trolley car; but the trolley car's retention of the horse car's exterior has been much closer than is possible in the case of the automobile. The point to be aimed at is, not to strike a balance between two conflicting features, but to unite and harmonize them. The trolley car found its body ready to its hand, needing only to be enlarged and strengthened. The motive power was put below the floor, on the truck; the trolley arm was mounted on the roof, and behind each dashboard—now become a wind-shield and hand rail support,—was mounted a controller. The combination fulfilled its purpose perfectly, and no one calls it incongruous.

To attain the same result, the builders of motor carriages will have to forget the horse carriages altogether, and consider simply the problem of carrying the desired number of passengers with speed, comfort, and safety, and with the minimum of effort in controlling and caring for the vehicle. The motor should be placed where it will be most accessible and will shake the carriage least, which is probably in front. The tanks, passengers, and transmission gear will then give the necessary traction. The wheels should be small or large, according to the nature of the road. The body should be as low as possible, to permit of high speed and sharp turns without upsetting. It should be no disgrace to show the cooling tubes if thereby they can be made more efficient. Machinery should be covered from dust so far as possible, but the suggestion of its presence is not a blemish, and should not be so regarded.

American builders have made great and striking progress in the last four years, in the elimination of freak machines and the settling down to sound mechanical principles; but the present American designs are likely to undergo much modification before they become standard. It is worth remembering that four years ago the French and German builders were producing designs very like the American designs of to-day, and the present radically different ones represent the survival of the fittest.

## AUTOMOBILE INFLUENCE AFLOAT.

THE power launch regatta of the Hélice Club is prophetic of the revolution destined to be wrought in launch design and powering as a result of the refinements in weight and speed introduced by vehicle motor builders. For boats of the same size, the speeds attained by these little craft are seldom matched in this country. The builders of launch engines may well take a leaf from the book of the automobile builders.

## ENCOURAGING THE PRACTICAL.

THE organizing by a leading Chicago newspaper of a series of competitive tests for motor vehicles, designed to give information regarding the practical qualities of durability, simplicity and the like, is an encouraging sign of the times. Nothing on so extensive a scale has been attempted before, and the success of the exhibition will mean much to the industry.

LAKE Forest, which is to Chicago what Newport is to New York, has been thrown into confusion by the invasion of its first motor carriage. The village board has grappled with the enemy by passing a speed ordinance, and also providing that an advance messenger shall precede the vehicle at a distance of a hundred yards, to warn the populace. This is the red-flag law over again. What's the matter with a bell?

BY the omission of a cipher in the editorial on "The Liquid Air Delusion in a New Form," we were last week made to say that 17,000 cubic inches of free oxygen, produced from liquid air, would cost $1. As will be seen by comparing it with the other figures in the context, this should have read 170,000 cubic inches.

## THE JULY EXPOSITION RACES.

The Sports Commission of the Automobile Club de France, at its meeting on June 28th, decided that the route for the July race of the Exposition should be from Paris to Toulouse and return. The several dates have been fixed as follows:

Wednesday, July 25: Start from Montgeron, arrive at Toulouse. Distance about 638.5 kilom. (396 miles.)

Thursday, July 26: Exhibition of vehicles at Toulouse.

Friday July 27: Toulouse to Limoges, about 305.6 kilom. (190 miles.)

Saturday, July 28: Limoges to Montgeron, about 382 kilom. (235 miles.)

Sunday, July 29, to Thursday, Aug. 2. Obligatory exhibition at Vincennes of the vehicles taking part in the race. The entry fees will be: for voitures, 200 francs; for voiturettes, 100 francs; for motocycles, 50 francs.

The official classes are: 1st., motocycles and motor bicycles weighing less than 250 kilos (550 pounds); 2nd, voiturettes weighing under 400 kilos (880 pounds.); 3d, voitures weighing over 400 kilos, and carrying at least two passengers of an average minimum weight of 70 kilos (145 pounds).

In addition to the prizes awarded by the Exposition management, which amount to 47,000 francs, the "A. C. F." will give bronze medals to all vehicles completing the course at a mean speed of 40 kilom. per hour, and silver medals to those averaging 60 kilom.

## THE INTER OCEAN'S AUTOMOBILE EXHIBITION.

The following is the preliminary program of the "International Automobile Exhibition and Race Meet," organized by the Chicago *Inter Ocean*, and to be held in that city during the week from Sept. 18th to 22nd inclusive. It is by far the most ambitious thing of its sort yet attempted, and will doubtless attract international attention. The final program will appear in our next issue.

On the opening day there will be a general parade, with standing and moving exhibitions, when the general public will be allowed to examine the vehicles in and out of the buildings and ride in them in the parks. Prizes will be given to the manufacturer presenting the greatest number of practical designs, and, second, to the manufacturer having the greatest number of automobiles in line. A special prize is offered for the most practical design of wagon for general purposes.

On the second day will commence the tests for general practical utility. All different forms of power will be classed together and vehicles of each different rating of power will be awarded honors and prizes in competition only with vehicles of like size. The vehicles entered for practical utility must be of standard design, construction and equipment, as regularly catalogued by each manufacturer for sale. In tests of practical utility, each manufacturer will be allowed to enter three vehicles, as follows:

One vehicle carrying two people, as operated by the owner of the vehicle.

One vehicle carrying four or six people, as operated by owner or servants in livery.

One vehicle as designed for commercial or merchandise delivery purposes, carrying a load of not less than 1,000 pounds with driver, nor more than 2,500 pounds with driver. The award to be in ratio of load and weight of vehicle.

In testing the practical manipulation of vehicles, a series of dummy figures will be introduced on the tracks, which will be constantly shifted, some remaining permanent, as the vehicles pass through them, causing frequent and sudden stops and turnings to show the safety of the vehicles in crowded thoroughfares, and the dexterity which may be attained by any intelligent operator. There will also be provided a section of extremely rough and uneven road, with mud and chuck holes, country road ruts, logs, stones and obstructions, requiring short stops and turns, and including both up and down grades, corresponding to country roads and city streets.

In these tests the following ratios of points will be established as winning values:

| | |
|---|---|
| Speed | 20 points. |
| (Above to be determined on a 5-mile run). (See 200 mile race). | |
| Elegance of carriage design and practicability | 20 " |
| Best arrangement of brake and control of speed | 20 " |
| Best climbing of grades | 20 " |
| Best and surest safety devices for operating vehicles on either grades or level | 10 " |
| Best, simplest and most easily accessible mechanical construction | 10 " |

There will be a hill-climbing contest, also a contest on an incline and decline grade, and a heavy draft contest, open for all heavy draft motor trucks built for commercial hauling. In this contest the following ratios of points will be established as winning values:

| | |
|---|---|
| Construction | 20 points. |
| Power | 20 " |
| Carrying capacity | 20 " |
| Design | 20 " |
| Control | 20 " |

After decisions have been rendered on tests covered by above rulings, the prize winners of each class will be allowed open competition on:

| | |
|---|---|
| Carriage design for general practical utility | 30 points. |
| Easiest manipulation | 30 " |
| Safety and emergency devices | 20 " |
| Cost of power per ton mile | 20 " |
| (Per ton mile to include complete weight of vehicle and passengers as well as any additional load that may be carried.) | |

The cost of electricity will be based at four cents per kilowatt hour, and the cost of gasoline or oil will be based on current market price per gallon.

In entering machines for all tests of a practical nature, manufacturers will be obliged to give the normal rated power of each vehicle, and a special prize will be awarded for the greatest range of useful power obtainable above and below the normal rating.

Without reference to power, one prize will be offered for the most original conception in an automobile as regards modifications and changes in carriage design that will still leave the vehicle acceptable and practical.

Four races will be given, in which speed alone will count for 100 points. Three of these will be of 20 miles each for steam, electric, and gasoline vehicles respectively, followed by a 40-mile race between the winners in each class. Any disabling of a vehicle during a race will disqualify it for further participation during that race.

There will be a 200-mile free-for-all fast track race—for owners—carrying four grown people: also a 200-mile track race, carrying two people.

A novel feature of the exhibit will be a mail race. Four mail boxes will be placed at equidistant points around the race track and ten miles will be run, making forty stops in all, to collect mail. Each driver will be obliged to stop at each mail box, unlock the box, take card from same, and lock again. An additional prize will be given for the design of mail wagon which shall be the most practical and best adapted to the collection of mail from street boxes.

There will be a 500-mile smooth track road race, free for all, to be run the fourth day commencing at 5 o'clock a. m.—100 points for speed. While this race is in progress, exhibition performances will take place on inner circle.

This will be followed by an automobile transfer express, which shall be run five miles, taking a swinging bag from suspended hooks at four points around the track without stopping. The man coming in first with 20 of these bags will be awarded first prize. This test will be open to any and all classes of vehicles.

A special gold medal will be awarded the operator of vehicles (of the commercial and catalogue type) who performs the greatest number of difficult tests and practical movements.

To demonstrate the merchandise delivery wagon, a race of three miles will be run, having eight stations on alternate sides of the track, at each of which must be left a package weighing not less than 20 pounds. Each wagon will be allowed a driver and assistant, as is the usual practice on such wagons. In this test the wagon shall not be required to come to a full stop, the driver and assistant operating together as best they can, but the winning vehicle must arrive at the finishing point with all packages delivered, and driver and assistant in their respective places.

After the races are over, a grand prize of $1,000 will be offered to the most valuable invention in automobiles, that shall have been practically demonstrated during the week of the exhibition.

Among the novel features on daily exhibition will be the following: One passenger vehicle will be given an eighth of a mile start of a second vehicle. The latter will overtake the first, and a complete exchange will be made of baggage, drivers, and passengers, with vehicles running at full speed. This is considered one of the most difficult feats in automobile driving. The award will go to the vehicles making the exchange while at the highest rate of speed. This will be immediately followed by a race of automobiles running backwards at full speed of one mile. The latter race will be open to any and all kinds of vehicles.

## AUTOMOBILISM AT THE PARIS EXPOSITION.--II.

By P. M. Heldt.

Tourand & Cie, of Havre, have a vehicle exhibited at Vincennes, which is provided with a double-cylinder balanced motor, with shafts rotating in opposite directions.*

The Societé Industrielle des Telephones of Paris show one vehicle and a number of motors of their construction. The motors are double-cylinder machines. The two cylinders being placed at 90° toward each other. Both pistons work on the same crank pin. The firm manufactures one 6-h. p. water-cooled motor for road vehicles and one 3-h. p. air-cooled motor for light vehicles (voiturettes). The former has a bore of 90 mm. (3.6 inches) and a stroke of 80 mm. (3.2 inches), and the latter a bore of 70 mm. (2.8 inches) and a stroke of 67 mm. (2¾ inches).

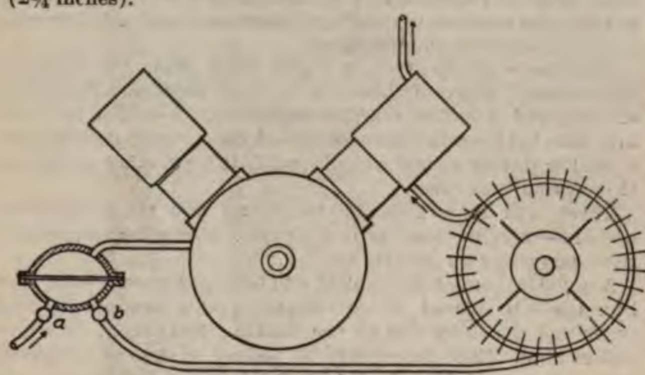

Fig. 4.—A Diaphragm Pump.

The method of water circulation employed by this company deserves description. It is shown diagrammatically in Fig. 4. As the two pistons ascend and descend nearly simultaneously, there is a sucking action created in the crank case. This sucking action operates the circulation pump. The pump consists of a chamber formed by two castings. The chamber is divided into two sections by a sheet of rubber. One of the sections connects by pipe to the crank case, and the other section has two pipe connections, one to the radiating pipe and one to the water tank. In these pipes are placed check valves, indicated at a and b. Valve a will open when there is suction in the chamber, and valve b opens when there is pressure in the chamber. Now, when the pistons ascend, the air in the crank case, and consequently in that part of the pump chamber which is connected with it, is rarefied. The rubber sheet will bulge toward that side of the chamber which is connected with the crank case, and water will flow into the other part of the pump chamber by way of valve a. When the pistons descend, the air in the crank case is compressed, and its pressure against the rubber sheet causes the valve a to close and valve b to open, through which latter the water flows to the radiating coil.

Ordinarily, the cooling or radiating pipes are bent back and forth and placed in front of the vehicle. The Société Industrielle forms the pipes into a coil, of considerable diameter, and places it over a flexible coupling connecting the engine and intermediate shafts. This coupling has fastened to it a number of fan blades, which stir up the air, and thus promote the heat radiation.

The Baudier voiturette, illustrated herewith, is an example of some of the light vehicles constructed in France. It weighs about 440 pounds, and is equipped with a 3-h. p. water-cooled De Dion motor. The body is in the form of a spider, and seats two persons. The makers state, however, that they will put on a detachable rear seat for a third person if desired. The vehicle has three forward speeds, but no reverse. The motor is placed in front, which is the mode of construction adopted by the majority of builders in France. The transmission to the driving axle is by means of bevel gears and a shaft running lengthwise of the vehicle, and connected at its ends by means of universal couplings, thus dispensing with the usual chains.

Fig. 8.—Hult Rotary Engine.

The same firm makes a still lighter vehicle, weighing only 330 pounds. This vehicle seats two persons, and is operated by a 2¾-h. p. De Dion air-cooled motor. It has only two speed gears.

* See The Horseless Age, Issue of July 11, pp. 17-19.

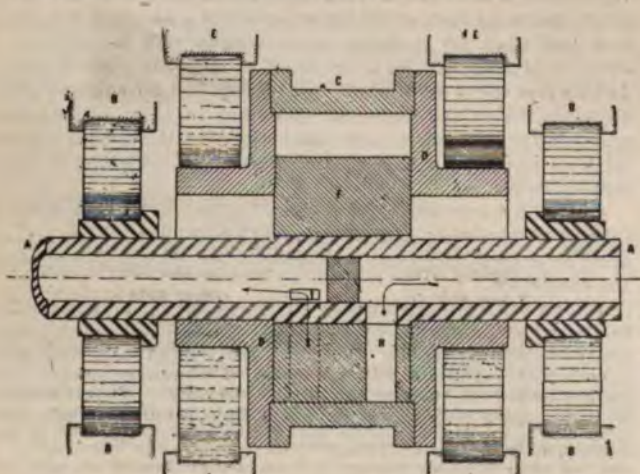

Fig. 6.—Section of Hult Rotary Engine.

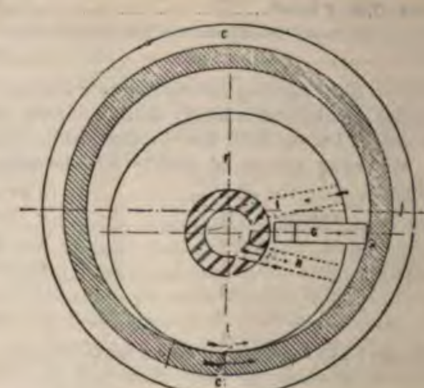

Fig. 7.—Section of Hult Rotary Engine.

The Actiebolaget Bröderna Hults Rotationsangmashin," Stockholm, Sweden, exhibits five rotary engines, two of which are driving dynamos, while one reversible engine is especially intended for automobiles.

From the drawings, Fig. 6 and 7, the arrangement of the parts and the mode of operation will be understood. F is a rotary piston, fastened to the hollow shaft A. The shaft A rests on two crowns of elastic (hollow) rollers B. The cylinder C, placed eccentrically with regard to the piston, is supported in a similar manner by the rollers E. Piston F in its rotary motion carries along cylinder C, owing to the friction at the point of contact J; these two parts have therefore the same circumferential velocity. The pressure of contact at J, between piston and cylinder, can be regulated at will, and this joint can therefore be kept perfectly steam tight.

The steam enters by the hollow shaft A, passes through the channel H, and acts on the slide G, first with full pressure and afterwards by expansion. The arrows indicate the direction of the motion. After a complete revolution, when the slide G is at the point of contact J, the space between piston and cylinder is filled with steam, having performed its work. As soon as the slide passes the line of contact, the steam begins to exhaust, by way of the exhaust channel I, while on the other side of the slide the newly-entering steam acts with full pressure.

All the working parts of the engine are enclosed. The lubricating oil is carried along by the steam which passes all through the enveloping case before exhausting into the condenser or into the air.

The automobile engine shown has a capacity of 8 h. p., and weighs 125 pounds. The steam consumption per h. p. hour running non-condensing on 150 pounds pressure, is stated to be 40 pounds. The speed of the engine is 3,000 revs. per min., and its extreme measurements are 19 inches x 16.8 inches x 12.8 inches.

Of the Kriéger electric vehicles three are to be seen at the space of the firm manufacturing them, and some more are exhibited by carriage builders in the carriage department at the exposition. The main feature of these vehicles is the method of attaching and gearing the motor. The steering knuckles are provided with an arm, to which the motor is fastened. In some cases the motor is placed directly on top of this arm and is fastened rigidly, and in some cases it is spring suspended, a flat spring rigidly attached to the arm on the steering knuckle supporting one side of the motor, the other side is pivotly attached to the knuckle arm. This arrangement admits of a slight motion of the motor in starting, and when applying the electric brake, and thus reduces the shock.

The motors, of which there are necessarily always two, are directly geared to the front wheels, a steel pinion on the motor shaft engaging with a hard fibre gear wheel on the hub of the driving wheel. The motors are four-pole machines, and are entirely enclosed. A special casing covers the commutators and brushes, and as there is no bearing on this end, the case is

Fig. 5.—The Baudier Voiturette.

easily removed for inspecting and adjusting these parts.

The accumulators are of the Fulmen type, and are placed partly in front and partly in the rear of the vehicle. The coupe-victoria has 1,050 pounds of batteries, and the total weight of this vehicle is 2,900 pounds. It seats four persons besides the conductor. The weight is divided as follows:

| | |
|---|---|
| Body, wheels and transmission | 1,560 lbs. |
| Motors | 290 lbs. |
| Accumulators | 1,050 lbs. |
| | 2,900 lbs. |

The controller has 11 positions, giving the following results: 1. Reverse speed. 2. Electric brake. 3. Stop—(changing position). 4. Starting forwards. 5. Accumulation. 6. Current recuperation at 40 volts. 7 and 8. Moderate speeds, and used for mounting grades. 9. Recuperation at 80 volts. 10 and 11. High speeds.

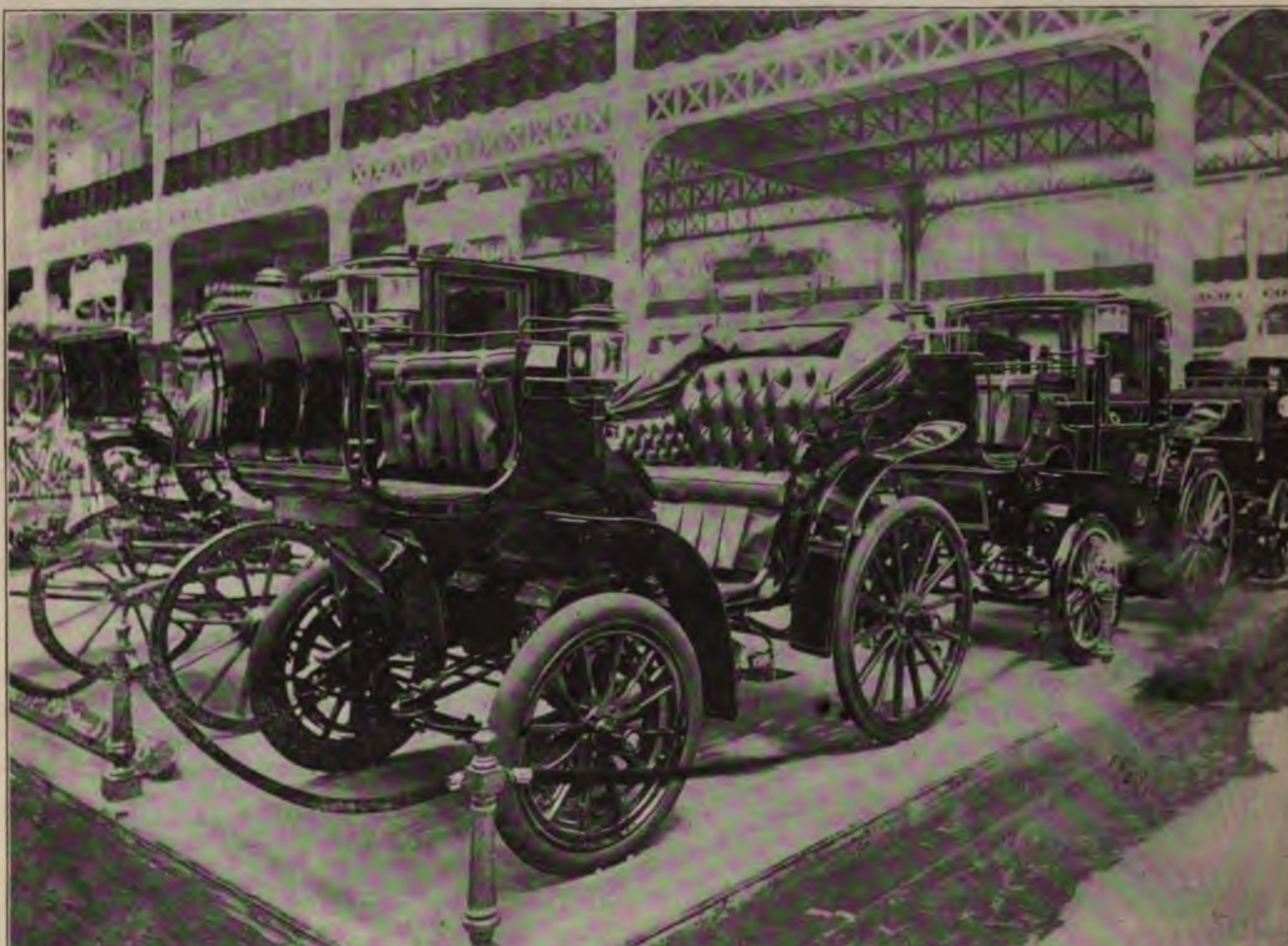

FIG. 9.—KRIEGER ELECTRIC VICTORIA.

## PATTERN MAKING FOR GASOLINE MOTORS--I.*

By W. O. ANTHONY.

The subject of pattern making, as connected with motor-vehicle construction, while surely a most important one, is seldom if ever touched upon in literature devoted to this new industry. There are many excellent works upon pattern making, but, unfortunately, so far as the writer is aware, they touch very lightly upon work developed by the needs of vehicle-motor practice, where water-jacketed cylinders and heads of special design, and in smaller motors the thin, radiating ribs for cooling purposes, prevail. A few instructions from a practical man experienced in this line of the work may assist many who would find it advantageous to construct their own patterns.

The novice, having only a general idea of the requisites to molding any pattern, is very apt to give the pattern far more draft than necessary. This will please the molder, but it entails extra and unnecessary machine work and adds more weight of metal to be paid for. Many patterns may be made to mold successfully with absolutely no draft; but, of course, the negative condition, or, as it is termed, back-draft, must never exist, in even the slightest part of any pattern, for this will surely break down the mold in drawing such a pattern. In patterns having many small and comparatively deep pockets, as for example, the usual form of ribbed cylinder-head, a fair amount of draft should be given at these parts, even 1 in. to the foot not being too much to insure perfect molding. The shrinkage of castings, about ⅛ in. to the foot, which must be taken care of in large work, may be considered negligible in the class of work in hand, for the rapping in removing from the mold will offset this shrinkage. In coring parts which are to be machined, the bore of the cylinder for example, enough metal should be left to allow of getting well under the scale,

*This article is the first of a series on pattern-making for small gas engines. The subject will be fully covered, and those of our amateur readers who prefer to make their own patterns, will find this series of articles most helpful and instructive.—ED.

and ⅛ in. of metal to be removed, that is, ¼ in. from the diameter, will be found sufficient with good quality castings. In a cylinder to have a bore of 2½ ins. finished, the core will therefore be 2¼ ins. in diameter. Upon flat parts to be machined this same rule will hold good, making the pattern ⅛ in. thicker at the portion to be finished. As a rule green-sand cores, as distinguished from those formed in boxes and baked in an oven, are to be preferred, as they necessitate much less work and there is no danger of work being spoiled by cores being set out of place. A good example of the superiority of a green-sand core is found in the inside of an ordinary hemispherical cylinder head.

A scroll saw of the amateur style will be found an almost indispensable tool in every portion of this work. It is much superior to a regular pattern-maker's saw for fine work. In getting the lumber for patterns a clear white pine plank, say 1⅝ ins. thick or 1½ ins. as it is called, should be secured. This should be cut into a few 3 ft. lengths and these should be resawed and dressed upon both sides in a planer to thicknesses running by $\frac{1}{16}$ in., from ⅛ in. to 1⅜ ins. The writer has found this a very satisfactory range of sizes, covering any style of work.

In gluing work together, any good prepared liquid glue is suitable; probably nothing will equal the genuine Le Page's glue. All corners or deep, narrow places must be filletted by running with wax to avoid sticking of sand in such places, which makes a rough casting. The traditional method of waxing patterns consists in heating a knife, similar in shape to a shoe knife, but shorter, in a candle flame, and gouging out a piece of the wax and forcing into the corner to be waxed, much as in setting glass with a putty knife. A method which the writer has used extensively, and which has always been productive of good results, is to take an ordinary candle, the variety sometimes called spermaceti, although all dealers in candles do not agree upon this, for at one time, asking for this kind, the writer was given the common white tallow kind. The latter will not do, being brittle, and cracking and leaving the pattern when the same is rapped during molding. The bluish-white candle is yielding, like wax. When your pattern is ready for waxing, light the candle and let the melted wax drop into the corners and crevices, holding the candle horizontally to facilitate this operation. A drop or two in most corners will suffice. Now take a common poker and heat moderately, and the wax may be run into all corners very nicely, and many places may be reached in this way which would be difficult to wax by other methods. Where a long fillet is required it is perhaps better to use the leather fillet now upon the market and glue into place. This makes a neater and more uniform job for such places. It may be had in many sizes from $\frac{1}{16}$ in. up; this latter will be found a good, all-round size for the variety of work in hand in this article. While upon the waxing of patterns a hint or two is in order. After gluing up your patterns, before waxing them, it is an excellent idea to run into the various glued joints some thick orange shellac from the brush. This is an excellent cement in itself, but most important—it being waterproof—it will prevent the entrance of water into these joints, to the obvious detriment of the pattern when the molder wets the sand surrounding it before removing from the mold. All patterns should be shellacked carefully, and this may be considered the final step in pattern work, unless we are to letter our patterns for reference, in which case white lead paint applied with a small camels-hair brush answers very well, unless it is desired that the reference letters should show upon the casting, when $\frac{3}{16}$ in. or ¼ in. white metal letters, to be had in the market, may be applied either with thick orange shellac or with small brads or pins. The former method is much neater, and if carefully done is very durable.

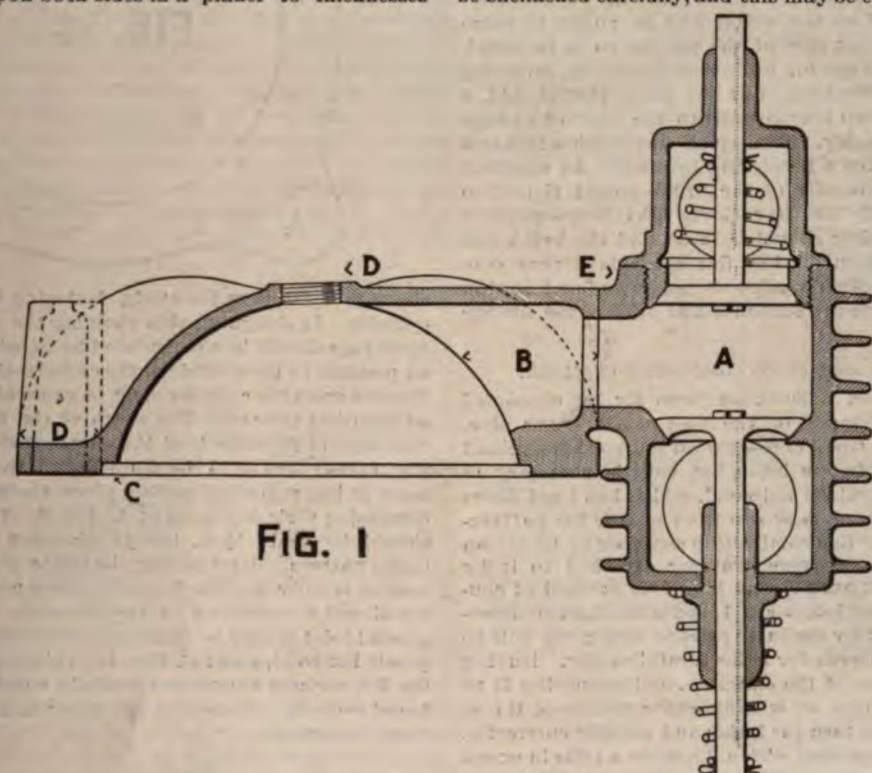


FIG. I

So far these remarks apply to wooden patterns. Brass patterns, desirable when many castings are to be had from any rather intricate pattern, will be spoken of later. The writer has tried many ways of mixing shellac varnish, and now uses the common wood-alcohol orange shellac, to be had at any paint store. This is much cheaper than the grain alcohol and has never given the writer a particle of trouble. There are, however, molders who will refuse to mold a pattern thus treated if they know it, and who will insist upon only the grain alcohol shellac for varnishing. It should be made somewhat thinner by the addition of wood alcohol, or, of course, grain alcohol, if the higher-priced shellac is used, than as secured from the paint

shop. Generally two coats upon pine patterns will be sufficient. The first should dry for at least ten hours and then be rubbed down with number 0 sandpaper and a second coat applied.

If castings in iron and bronze are to be had, or in any dissimilar metals, it is well to so indicate upon the patterns. All core-prints should be designated; and with split patterns the outline of the core should be represented upon the inner side of one-half of each. These little details help to avoid mistakes in setting cores and are worth attending to.

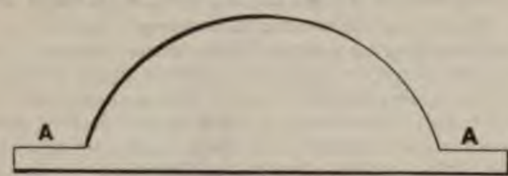


FIG. 2

The practice followed by the writer and in vogue in some foundries is to shellac that part of the pattern to be in metal, black for iron and orange for bronze or aluminum, reversing these colors for the core-prints. For the black shellac add a little lamp-black, say two teaspoonfuls to the pint of orange shellac, and stir thoroughly. To keep shellac brushes soft and in good condition is often a perplexing problem. An excellent way is to whittle the handle of the brush round, if not so already, and fit it tightly into the cork of a fairly large-mouthed bottle in which the shellac should be kept, and the brush not quite touching the bottom. A 1-in. flat brush is a very convenient size. Of course two brushes should be had and kept in their respective jars, one for the black and one for the orange shellac.

### PATTERN FOR AN AIR-COOLED COMBUSTION-CHAMBER.

This is one of the most difficult patterns for an air-cooled motor. It should be made of the best white sugar pine, thoroughly seasoned. Good close-grained redwood is excellent for parts to be turned in the lathe, but care is necessary in selecting it, as coarse-grained redwood, which has hard fibres traversing the whole mass, is worse than useless for pattern-work. We will suppose this combustion chamber to be for an upright motor, having the valve chamber attached to it by stud bolts and the joint ground to a fit. This method of construction is shown in section in Fig. 1, and with slight modifications in the valve chamber the same rules as here given will be correct for making patterns for a horizontal motor. Having determined upon the size of the chamber, and supposing it to be hemispherical as shown, we will lay out templates of tin or cardboard, by which to turn the inside and outside corrrectly. The inside should be described with a diameter a trifle in excess of the finished cylinder-bore. This will allow the piston to overrun the cylinder end and thus prevent wearing to a shoulder. This template will appear like Fig. 2, in which the part AA is to be brought against the under side of the pattern when finishing for the depth.

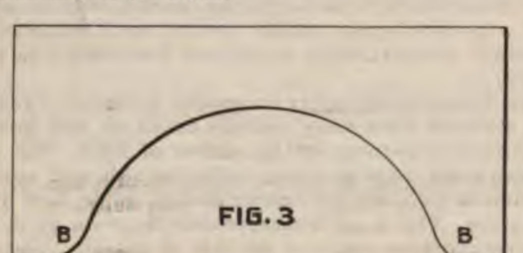


FIG. 3

The proper thickness for the shell of the chamber will depend upon the size of the motor, and will vary from ⅛ in. in the smaller sizes to about ¼ in. in the largest sizes, to which air-cooling is successfully applied, found in practice to be about 3¼ in. bore. Supposing our motor is to be of the first variety, we will allow ⅛ in. for the shell, and for our outside template the radius must be ⅛ in. larger. This template will appear like Fig. 3, in which the base line, BB, must be calculated so as to leave a proper thickness of flange around the bottom of the chamber, say ⅛ in. This flange should now be sawed from $\frac{7}{8}$ in. stuff, which will allow a shaving to be taken off both sides in turning it up. This flange will now appear as in Fig. 4, in which lugs A are for the reception of the four bosses,

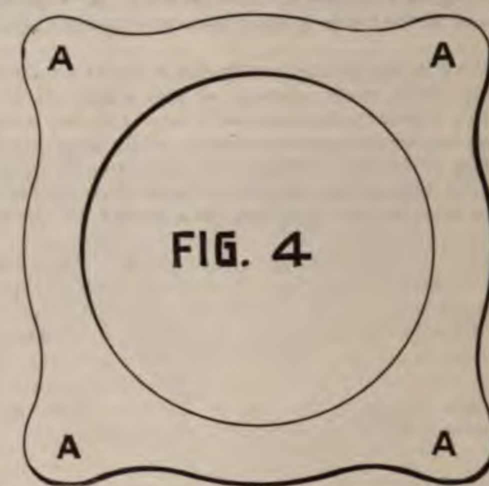


FIG. 4

through which pass the studs, fastening the chamber to the cylinder. In designing this chamber the size and location of these lugs should be so calculated as to bring the studs as close as possible to the outside of the cylinder-shell. On this account the ribs upon the cylinder must be grooved to let in the studs, as described later on. The width of the flange, or its projection beyond the outside of the chamber shell, as shown at D, Fig. 1, may well be ⅓ the diameter of the cylinder bore, and more or less radiating surface given the ribs by increasing or decreasing their depth, as at A, Fig. 2. The hole in the flange should be made ¼ in. less in diameter than the final size in the pattern. Since neither the inside nor the outside of the casting is to be machined, no allowance need be made for extra metal and counterbore in the chamber: where it forms the ground joint it may be machined out of the square corner purposely left solid, as at C, Fig. 1. This construction, in which the flat surfaces are ground carefully together, the writer has found perfectly reliable and has never had a leaky joint when thus constructed.

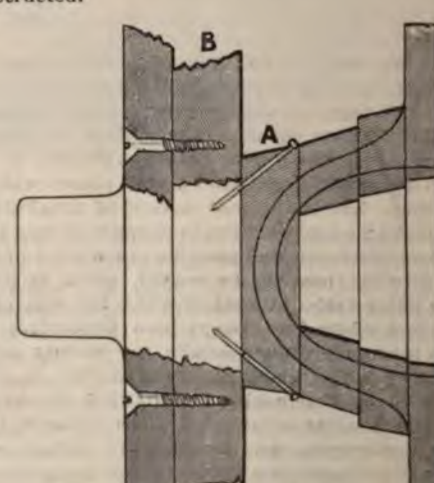


FIG. 5

In a small chamber of this kind it is sufficient to build up the body of the pattern with two or three layers of 3/8 in. or 1/2 in. stuff glued and clamped together with the grain running at right angles in adjacent layers. These layers should be sawed round and the centres sawed out about 1/4 in. less in diameter than the finished size, as in the case of the flange. A scroll-saw with tilting table will allow of their being sawed on a taper, which saves some lathe work.

Fig. 5 shows a sectional view of the flange with layers sawed and glued in place, showing the outline of this part of the pattern finished, also the method of fastening to the face-plate of the lathe, supposing a regular screw-chuck is not available. The block B, of 7/8 in. or 1 in. stuff, is fastened to the face-plate by three No. 10 or No. 12 screws, passing through holes drilled in the plate. This block is then faced off straight and true, and the pattern is centered and fastened with about six 1/8 in. brads. The block A is made as large as the layer below it. This facilitates the driving of the brads. In centering the patterns upon the face-plate use the point left by the dividers in describing A, as a guide. Drive a brad straight through this point and into the center point formed in turning off B. Now face off the outer surface of the flange, taking off about 1/32 in., then rough out the inside to the appoximate size and shape. An excellent tool for this work is made by grinding the tang of a 10 in. flat file to a diamond point, as in Fig. 6. The work may be nearly finished with this tool, applying the template repeatedly. Take the final cuts with a sharp gouge of medium size, say [illegible] in. Sandpaper with No. 1 1/2 and finish with No. 0.

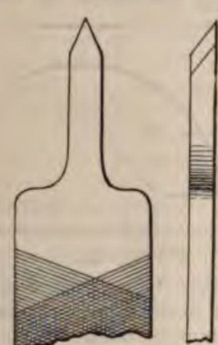

FIG. 6.

Now remove the work from the face-plate and fasten a block of 3/8 in. stuff in its place with a few brads. Turn this block down, so it will fit tightly into the bore of the inside of the pattern. Rap the pattern lightly into place over this block, and fasten by driving about eight 1/2 in. brads through the flange, from the sides, two to each side, as in Fig. 7, at A. Now trim off the outside, using the other template as a guide, after having first taken off 1/32 in. from the top of the flange, bringing it to its finished thickness, 1/8 in. Finish with sandpaper as before.

Now turn out the four bosses for the corners. If the studs are to be of 1/4 in. diameter these bosses should be made with a diameter at the top for a 1/4 in. hexagon nut, which is 5/8 in., and of a height such that the corners of the nut will clear the rib back of each boss. About 1 1/4 in. high will answer in most cases. For the sake of lightness these bosses should be made hollow and this is best done by coring the casting. Therefore the core-print for the top should be turned upon each boss 1/4 in. diameter, and should extend above it at least 3/8 in., and be given more taper than the boss itself. The centre points having been marked upon the flange lugs, a circle about 11/16 in. diameter should be described to serve as a guide fastening the bosses in place, after having driven a small brad through each of these points to the other side and then withdrawing them. This will serve as a guide for the (loose) core-print on the under side, to insure getting both prints in line. Now fasten the bosses in place with glue and one or two 7/8-in. brads. Drill a 1/4 in. hole in each of the centre points, on the under side, to a depth of about 1/4 in.

In coring these bosses the sides should be as thin as will run in iron or steel: about 3/32 in. is thick enough. This indicates a core 7/16 in. diameter for the body of the boss, and this size should extend to within 1/8 in. of the top of the boss, this thickness being sufficient to allow of facing off the top to form a surface for the nuts. The print at the bottom should be the same diameter as the body of the core, 7/16 in., and should extend below the pattern 1/4 in. Here it may be stated that all dowel pins in loose prints or split patterns should be just loose enough in their holes to drop out of their own weight.

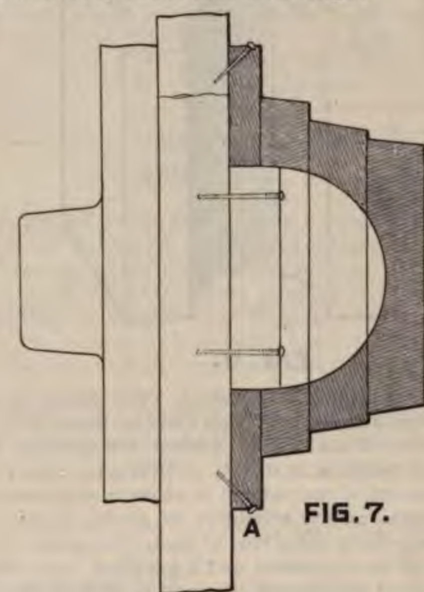


FIG. 7.

Fig. 8 shows the appearance of one corner of the pattern with the boss and prints in place, also the outline of the core.

Before proceeding with the ribs we will consider the core-box for the boss. Most cores in which the halves are not rights and lefts may be made from a half box. The almost universal practice in core-box making is to gouge out of a block by hand the shape desired for small boxes. A practice which is much quicker, just as good, and, so far as the writer is aware, is original with him, is to saw out the parts upon the scroll saw

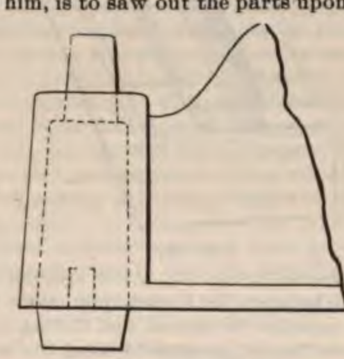

FIG. 8.

and glue together, afterward strengthening them by nailing thin stuff upon the sides. In the case of the box for these bosses the 7/16 in. core is straight for 1 1/8 ins. Therefore a piece of 1 1/8 in. stuff of a size to leave, say 1/4 in. margin around the core impression, or about 15/16 in. x 15/16 in., should be sawed out and an exact semicircle of 7/32 in. radius should be described, as in Fig. 9. For the top print a piece 1/2 in. thick and of the same dimensions as the body of the box should be cut with a semicircle of 1/8 in. radius; and for the bottom print, a

piece of ¼ in. stuff of the same outside dimensions should have a semicircle with $\frac{7}{32}$ in. radius, cut as in the others. In these impressions for the prints the semicircles should be cut upon a taper to correspond in size and shape with their respective prints. These three sections should now be glued together, and when dry strips of say $\frac{3}{16}$ in. thickness should be nailed first across the ends, and then similar strips along the sides, nailing thoroughly with ½ in. or ⅝ in. brads. The box complete will appear as in Fig. 10.

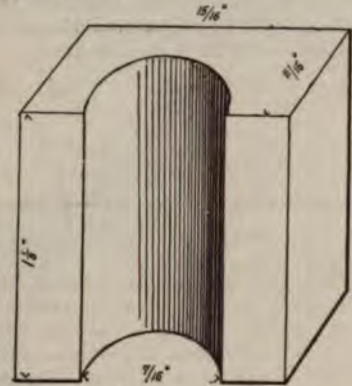


FIG. 9.

For the ribs ⅛ in. stuff will answer. They should be placed as closely together as posible. Their distance apart will be limited by the ability of the molder to draw the pattern from the mold without breaking it down. About $\frac{7}{16}$ in. apart between centres at the rim of the pattern is close enough, and at this distance extreme care is necessary in giving all the ribs the draft necessary upon either side of each. The shape to be given the ribs should be determined and a template cut of this shape. The inner edge of the ribs will of course be laid off from the outside template for the head. A good shape for the outer portion is shown in Fig. 11. Between each boss and the outside of the chamber should be fitted a rib which acts as a stay for the boss.

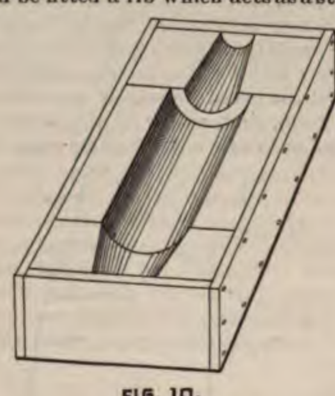

FIG. 10.

This rib will appear as in Fig. 12. After spacing off the portion of the flange between the bosses upon three sides of the pattern so as to equalize the spaces, and finding the number of ribs required, these should be marked from the template and sawed out very carefully. Then with a sharp block plane the requisite draft should be given them. A convenient method of holding them for planing is to saw a piece of ⅛ in. stuff having an opening into which the rib will slip. Nail this piece to the bench, counter-sinking the brads to prevent dulling the plane.

Fig. 13 shows the method of holding. Plane this piece down with the first rib and the remaining ribs may be guided for thickness by this piece. After all are planed upon one side they should be planed to a finish upon the other side. Starting with but ⅛ in. stock, very little is to be removed anyway, and the outer edge should be made the thinnest.

The part to form the passage connecting the combustion chamber with the valve chamber is next to be attended to. This part should be as short as possible. The outer end may be made even with the outer edge of the flange. This will allow the valve chamber to project beyond the cylinder sufficiently to be reached by the gearing to advantage. The outside diameter may be the same as the height of the chamber above the top of the flange. This piece must be cored in the casting, and the simplest and best way to effect this is by two cores technically known as "overhang" and "stop-off" cores. The first cores

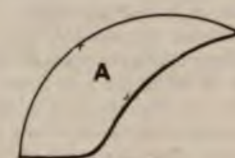


FIG. 11.

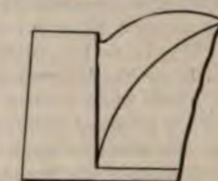

FIG. 12.

out the opening, and, as its name implies, the print for this core hangs over the pattern sufficiently to allow the weight of the print of the core to overbalance the weight of the part projecting into the mold. The second, or "stop-off" core is for the purpose of cutting under the part forming the passage While not absolutely necessary, this second core adds but little work and saves a few ounces in weight, besides making a neater looking construction. This cutting under is shown in Fig. 14 at AA. Having determined the diameter of this part

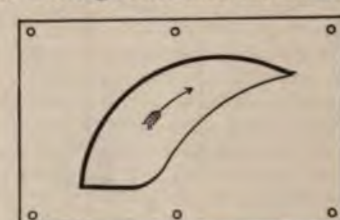

FIG. 13.

we will turn it up, letting the part forming the body of it be a little larger than when finished upon the pattern, and the print must be made of the diameter the hole is to be in the end of this passage, and this hole should be calculated so as to leave $\frac{3}{16}$ in. on the diameter to machine upon. The length of the print should be made about the same as DE, Fig. 1. This print should

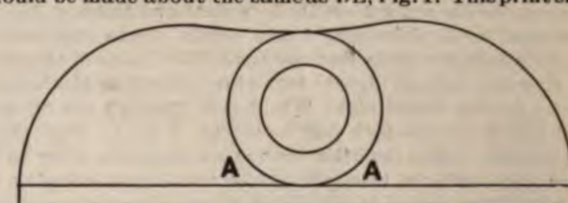


FIG. 14.

be turned parallel its whole length. The part to be fastened to the core chamber should now be sawed to a curve to fit the head nicely, and glued, and when dried two or three brads driven in. The print for the stop-off core should now be put in place. This will appear as in Fig. 15, the line AB being at the centre of the print; and the whole piece, if removed w th both prints attached, would appear like Fig. 16. Slight draft should be given at A and at B, Fig. 16.

The core boxes are next in order. The shape of the core where it cuts the casting is shown at B, in Fig 1. The core box for this core requires two halves, it being right and left. Two pieces should be sawed from stuff of a thickness a little more th n equal to the length of the enlarged portion of B, Fig. 1, and semicircular in section, having a diameter equal to that of B. Two other pieces must be sawed from stuff to equal in

thickness the length of the contracted portion added to the length of the print. These pieces are to be glued together, and the end having the larger core impression must be sawed upon a curve the same as the inside of the head, after measuring very carefully, so as to have the curved end just reach the inside of the head. One-half the core-box will appear like Fig. 17 the other half will have the curved end sawed in the opposite direction.

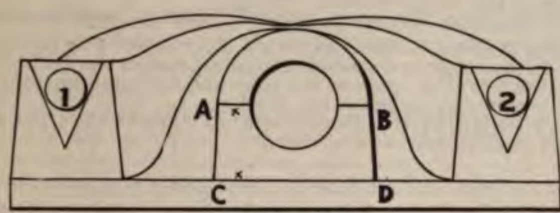


FIG. 15.

To make the box for the stop-off core, turn a piece of the same length and diameter as the round core-print upon the pattern. This should be turned from two pieces glued together longitudinally, with paper between, and when finished split down with a knife. This will give a half section of the print.

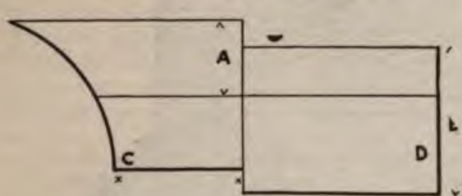


FIG. 16.

Now take a piece of stuff of the thickness XX, in Fig. 16, and saw a semicircle from it, having a diameter equal to that of the outside of B, Fig. 1. Now take a block of the thickness of XX, Fig. 15, and saw out an opening the same length as CD, Fig. 16, and the same width as CD, Fig. 15, giving the sides of the

FIG. 17.

opening the same taper as the stop-off core-print, using the dimensions specified for those of the larger side of the opening. Now lay the block, with the larger side up, upon any flat piece and glue in place. Glue the two semi-cylindrical pieces end to end in the exact centre of the opening, each with the flat side down.

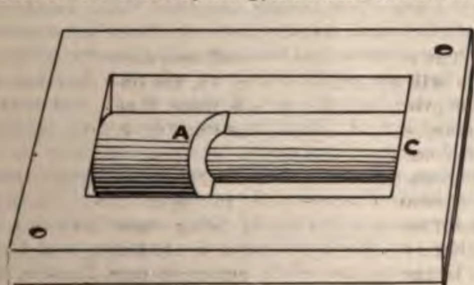


FIG. 18.

Fig. 18 shows this box at this stage. Take a piece of the same thickness as the flange forming the base of the head, and saw from its centre an opening like Fig. 19 and of a size outside sufficient to form a cover for the box shown in Fig. 18.

This opening should have the width XX equal to the width of the box inside in Fig. 18, and its length at AB the same as that of the overhang core-print. The curve in the end of this piece

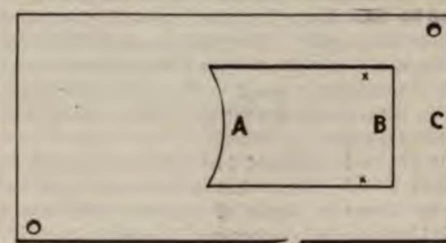


FIG. 19.

should be struck off with a radius equal to that of the outside of the flange, and having its centre in an extension of the centre line of the opening. This piece is to be fastened to the top of the box in Fig. 18 with two loose dowel pins and so placed that the openings at the end C will coincide. This should bring the point A, Fig. 19, exactly in line with point A, Fig. 18. Sharp corners in this box should be waxed and the box given two coats of shellac.

Glue the ribs into place, at the points spaced for them, and turn a boss to machine the casting by and fasten in the centre at the

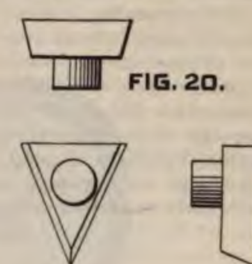

FIG. 20.

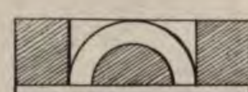

FIG. 18.A.

top of the head. A boss ¾ in. in diameter by 1 in. long is heavy enough for small castings. All that now remains to do is to make the two small bosses as at 1 and 2, Fig. 15. These are for the small stud-bolts which are to hold the valve chamber to its ground seat against the combustion chamber. These must be made as shown in Fig. 20 in end and side elevation and plan. They must be dovetailed into the bosses either side of the valve chamber passage with the centre of the small boss in a line horizontally with the centre of the passage. They should fit quite loosely, so they will drop out of their own weight. After waxing and varnishing as already described this pattern is ready for the molder.

[We have added a sectional view of the core box, Fig. 18, giving it the number 18A, in order to make its construction clearer.—Ed.]

## NOT A SINECURE.

The following advertisement, according to *The Locomotive*, recently appeared in a Minneapolis paper, under the heading "Wanted—Locomotive Engineer. I want a man who can run a Shay Gear Lima engine for logging railroad; I don't want excuses, I want logs. I want a man who can climb into the firebox and calk his flues with 60 pounds of steam on, and who can 'get there' without having a machine shop under the cab eaves. In short, I want an engineer who will not burn out the telegraph line with complaints to headquarters. Work in Wisconsin. Steady job with adequate pay to the right party."

## KEYSTONE PARCEL DELIVERY.

We illustrate the Keystone Parcel Delivery Wagon, which is the latest product of the Keystone Motor Company of Philadelphia, Pa.

This little delivery wagon has many of the characteristics of the Keystone autocycle made by the same company. It is equipped with a 4-inch x 4-inch Keystone water-cooled motor and carries fuel enough to run 10 consecutive hours.

The motor is controlled by the operator, and is provided with a hill-climbing gear. The fast speed is fifteen miles per hour. At this speed any grade up to 10 per cent. can easily be taken. The hill-climbing speed is five miles per hour, and at this speed the wagon can travel anywhere where the driving wheels can get traction.

The wheels are 30 inches and 34 inches in diameter, with 2½-inch pneumatic tires. The spokes are 3-16 inch wire and laced tangent. The frame is made of 1½-inch steel tubing. The tanks and fittings are all copper and bronze.


The operator sits directly over the engine, the seat being so arranged that it may be easily removed, should it be necessary to get at the motor.

In the steering handle is located a push button, which controls an electric gong.

The parcel case is made of sheet steel. The cover or lid hinges in front, and has a lock facing the operator. This cover is balanced by weights, so that when it is lifted it will stay in any position it may be placed in. A brass rail surrounds the cover, allowing small parcels to be carried on top.

The parcel case, as will be seen, is suspended on the frame by two easy carriage springs. This is quite an important element, as it is often neccessary to transport very frail goods, which would be damaged were they to be subjected to any severe shocks.

Another noticeable feature is the ease with which the operator can get off and on his machine, the distance from the ground to the frame being only eleven inches.

These machines are built for the hardest kind of work, and anyone familiar with delivery service will appreciate how substantial a wagon must be in order to stand the very rough and constant usage received in this service.

The cost of operating the delivery wagon is, approximately, three cents per hour. This includes fuel, oil, waste, etc., but does not include wear and tear or the operator's wages. The wear and tear will, of course, depend much on the character of roads traveled, care received, etc.; but it is reasonable to estimate, from past experience, that the wear and tear will not exceed 15 per cent. per annum. The finish of the vehicle is the same as that of the best makes of bicycles. The parcel case, frame, motor, etc., are enameled any desired color. The hubs and spokes of the wheels are nickel-plated.

The Keystone Motor Company inform us that they are building vehicles of this type with special cases. For instance, for a hatter, they are making the parcel case in the shape of a large silk hat that opens at the top; and for a patent-medicine man, the parcel case is a large bottle.

These designs attract much attention when on the street and form a good means of advertising.

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The Plainfield Automobile Co., capitalized at $100,000, was organized July 11th. The promotors of the scheme plan to provide a public transit service in sections of the city not accommodated by trolley car lines. The incorporators of the company are Mayor George Rockfellow, of Plainfield; Mayor N. B. Smalley, of North Plainfield; S. D. Drake, E. M. French, D. M. Smalley, and Craig A. Marsh. The automobiles will carry ten persons each, and the fare will be ten cents.

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## INHERITED LOVE OF SPEED.

The New York *Press* points out that W. K. Vanderbilt, Jr., whose fast Daimler machine has so disturbed Newport, inherits the love of speed that has been in the Vanderbilt blood from the first. With the old Commodore, with his brother, Captain Jacob, and the former's son, William H., it was fast horses William H.'s day of triumph was when, with Maud S. and Aldine, he lowered the record for a double team in harness. With Cornelius and William K. it was fast railroad trains, and the Empire State Express is the monument to the love of speed in that generation of the family. Now come Cornelius, Jr., and William K., Jr., the latter with his Daimler, and both with yachts. The performances of the 70-footers, Yankee, Rainbow and Virginia, sister boats to the Mineola, are of present-day fame.

# ...OUR... FOREIGN EXCHANGES

## VEHICLE MOTORS FOR MARINE WORK.

On the 23rd and 24th of June a regatta of power launches was held at Argenteuil on the Seine, under the auspices of the Hélice Club, at which some noteworthy records were made in the way of speed.

Gasoline, steam, and electric launches were entered, and were classed in four groups according to their length. The course on the first day was up the river, then down to a point below the starting point, and finally a return to the starting point. Equal distances up and down the river were thus made, and a mean speed obtained from which the effect of the current was eliminated.

A synopsis of the results is given below, for the leading three boats in each series.

On the second day the course was from 12 to 24 kilometers. The results were much the same as on the preceding day, except that in the third series a launch with a "B. G. S." (Bouquet, Garcin, et Schivre, of the Société des Voitures Electrique et Accumulateurs, B. G. S.) electric motor, and called the *Riquiqui*, made 20 kilometers in 1 hour 30 minutes, a minute less than the *Ellen*, which finished second. The pilot of the *Riquiqui*, by an unfortunate blunder, had stopped the boat at the last turn on the previous day, thinking that the course ended there.

*L'Aiglon*, according to *La Locomotion Automobile*, has a beam of 1.35 metres, or 1.25 as the water line, and draws 0.25 metre without the screw.

We are indebted to *La France Automobile* for the table of results.

## AN AUTOMOBILE GYMKHANA.

Under the auspices of the Ranelagh Club, of Barnes, S. W., an "Automobile gymkhana" was held at Ranelagh on Saturday, the 14th, in which members of the above club and of the Automobile Club of Great Britain participated. The events included maneuvering contests, starting tube ignition carriages from "cold," a ladies' race, obstacle races with "stunts" of various sorts, and a stating and stopping handicap. A praiseworthy feature of the occasion was an arrangement by which members of the Club could send their horses to Ranelagh in the morning of that day, to be trained in the presence of the motor vehicles.

The Moto Club de France now has over four hundred members enrolled on its books.

## THE RECENT TRIALS OF MOTOR VEHICLES.*

By H. S. Hele-Shaw.

The credit of the satisfactory carrying out of a road trial of 1,000 miles, in which a large number of light, self-propelled vehicles have visited, and been exhibited in the chief towns of the country, thus enabling a comparison to be made of the special features and actual performance of the numerous types of motor-cars now before the public, is due to the Automobile Club of Great Britain. Some idea of the care with which the rules and regulations were drawn up, the completeness of the contour and other maps, as well as of the road instructions, may be realized from the fact that the official program consists of a volume of more than 200 pages. It may be fairly said that it was the great object of the club, as well as of all who took part in the trials, that nothing should occur to hinder the progress of a movement, the development of which not only promises much enjoyment for the users of both private and publicly owned vehicles, but also solid commercial benefits from the use of light vehicles for trade purposes, and the growth of a new and important industry in this country.

Advantage was taken of the contour of the country at certain places to have hill-climbing trials. At three of these places—viz., Taddington, Dunmail Raise, and Birkhill—all competing vehicles had necessarily to make the ascent, as the hills formed part of the route, and all did so successfully; while the speed tests on Shap Fell, which were optional, were successfully undertaken by 26 of the vehicles. The results showed that while the average speed in these steep ascents was in all cases ample for all requirements of touring and pleasure, the possibilities of high speed under such circumstances by modern motor vehicles are abundantly proved. Thus the car of the Hon. C. S. Rolls, a 12-h. p. Panhard vehicle, was able to take the steepest of these ascents at 16 miles an hour, while the first and longer part of Shap Fell was taken at the almost incredible speed of no less than 27 miles an hour, the long and steed ascent of Dunmail Raise being made at 20½ miles an hour. In the case of Taddington, Dunmail Raise and Birkhill, Mr. Rolls had the usual complement of four passengers on his car. It may be stated that in the Shap trials vehicles were made to stop at the dip, between the two portions of Shap Fell, and to ascend the steeper portion from a standing start, under which circumstances the average speed of nearly 18 miles an hour on the latter was attained by Mr. Rolls. This performance is all the more remarkable since the official weight of this car unloaded was more than a ton, while the trials were not made after any special preparations, but as a part of the ordinary day's run on a long tour.

* Supplementary paper to the one on "Road Locomotion," read before the Institution of Mechanical Engineers

| Name of Boat. | Motor. | Power of Motor. | Length of Hull. | Time. |
|---|---|---|---|---|
| **First Series: Under 6.5 metres. Course, 50 kilom.** | | | | |
| L'Aiglon | de Dion-Bouton | 4 h. p., gasoline | 6.45 metres | 3 h. 40 m. 19 s |
| Souris Blanche | de Dion-Bouton | 3½ h. p., gasoline | 6.45 metres | 3 h. 53 m. 2 s |
| Surprise | Dumas fils | 3½ h. p., gasoline | 6.40 metres | 4 h. 19 m. 8 s |
| **Second Series: 6.5 to 8 metres. Course, 50 kilom.** | | | | |
| Olifant | Gaillardet | 6 h. p., steam | 8 metres | 4 h. 21 m. 2 s |
| Rainette | Forest | 2½ h. p., gasoline | 7.5 metres | 4 h. 26 m. 0 s |
| Isabelle | Bonneville | 2 h. p., steam | 7.93 metres | 4 h. 26 m. 3 s |
| **Third Series: 8 to 10 metres. Course, 65 kilom.** | | | | |
| Lisette | Tangye | 3 h. p., steam | 8.29 metres | 4 h. 40 m. 45 s |
| Suzette | Schindler | 7 h. p., steam | 9.9 metres | 4 h. 41 m. 14 s |
| Ellen | Forest | 4 h. p., gasoline | 8.77 metres | 4 h. 43 m. 40 s |
| **Fourth Series: 10 to 15 metres. Course, 78 kilom.** | | | | |
| Phénix | Phénix (Panhard-Levassor) | 18 h. p., gasoline | 12 metres | 3 h. 49 m. 38 s |
| Suzanne | Schindler frères | 15 h. p., steam | 13.75 metres | 4 h. 23 m. 20 s |
| Favorite | Schindler frères | 12 h. p., steam | 14.5 metres | 4 h. 33 m. 0 s |

Winning Boats in Regatta of the Hélice Club.

Coming to the general statement of results, it may be said that 83 vehicles entered, out of which 18 did not start. Among the starters there were no electric vehicles, and only two steam, and of these only one—viz., the Stanley steam motor-car—ran through the entire trial. The vehicles, with the above exception, were driven by petroleum spirit motors, and the results showed the entirely trustworthy nature of this motor, and how admirably it is adapted for employment on light vehicles. The following is a brief tabulated summary of the general results:

| Type of Vehicle. | No. Entered. | No. Started. | Vehicles with average speed throughout the trials of | | | Off the road one or more days. | No. Failed. |
|---|---|---|---|---|---|---|---|
| | | | 12 miles | Above 9 | 5 to 8 miles. | | |
| Carriages | 48 | 33 | 7 | 15 | 1 | 8 | 2 |
| Voiturettes | 26 | 24 | 3 | 8 | 1 | 7 | 4 |
| Motor Cycles | 9 | 8 | 2 | 1 | — | 4 | 2 |

It may be interesting to put the above particulars in another form, and the following table gives the details of the trial dividing the vehicles into those owned and driven by private individuals and those entered by manufacturers:

| Vehicle. | No. Entered. | No. Started. | Vehicles with average speed throughout the whole trial of | | | Off the road one or more days. | No. Failed. |
|---|---|---|---|---|---|---|---|
| | | | 12 miles | Above 9 | 5 to 8 m. | | |
| Privately owned and driven | 29 | 20 | 6 | 7 | 1 | 6 | 2 |
| Entered by makers | 54 | 45 | 6 | 17 | 1 | 13 | 6 |

Altogether, about 50 vehicles, out of 65 which originally started, formed into line at St. Albans, in order to run together into London, to complete the tour at the buildings of the Automobile Club. Of those which actually broke down in one case the crank shaft was broken; in another there was a fractured piston rod and broken counter shaft; in another the steering axles were fractured; in another the parts were strained in consequence of a collision with a wall. One of the two steam vehicles failed, owing to a cylinder head breaking, but it safely returned to London; in another case the front axle bent through excessive strain; another broke its crosshead and wore the cylinders; in another vehicle the frame and wheels turned out to be faulty, and would not stand the wear of the run; while in one the body of the vehicle itself (*i.e.*, the woodwork) gave way.

All engineers are aware that such failures as these are only to be expected in any new class of machine, particularly where the vibrations and strains are so exceptional as in the case of a vehicle running at a high speed upon the common road, and where the weight of every working part must necessarily be reduced to a minimum; but the entire absence of anything like a severe accident, from any breakdown of the working parts, in the run, where no vehicle did not at some time or another attain a speed of at least 25 miles an hour, upon the road, in each day's run, while many far exceeded that speed, must be regarded as a most encouraging result.

Although, in general, no official recognition was made of any speed above the legal limit of 12 miles an hour, it was well known that speeds exceeding 40 miles an hour were attained upon roads free from other traffic. In one case a well-known vehicle successfully raced an express train for several miles. What can be done in this direction by the modern motor carriage is, however, best illustrated by the result of the road race between Paris and Lyons, in which the winner, M. Charron, covered 353¾ miles in nine hours 8 minutes, thus beating the express train, which takes 8 hours 53 minutes to travel the shorter route of 320 miles.

The pneumatic tire and its advantages have been considered at length in the original paper, and it is interesting to note that, with one or two exceptions, all the vehicles in the run employed this type of tire. There is little doubt that the general freedom from failure of the working parts was largely due to the use of such tires; and, as far as could be gathered upon the various parts of the run, these tires had, on the whole, given remarkably little trouble. Nor had the results of wear been anything so great as had been expected, and the tires of most of the cars at the end of the 1,000 miles' run appeared, as far as could be ascertained from inspection, very little the worse for wear.

Probably the most important lesson of the whole trial was the absolute necessity for constant care and attention, in order to obtain such results as have been recorded, and in view of the general introduction of the motor vehicle for pleasure purposes, the necessity for skillful attention cannot be too strongly urged, in order to avoid not merely exasperating delays, but possible breakdowns, which might cause something more than a mere annoyance.—*The Mechanical Engineer.*

## A SELF-REGULATING IGNITION DYNAMO.

Those who have experimented with ignition dynamos know that a generator designed on orthodox engineering lines is quite unsuited for ignition purposes, because it is necessary that such a generator should give a nearly constant current over a wide range of speeds. A gas engine is apt to require a stronger spark when starting than when at normal speed, and an ignition dynamo designed to give normal current at normal speed will ordinarily give a very feeble current, indeed, when the flywheel of the engine is turned by hand. One way of getting over this difficulty is to wind the field magnets for supersaturation at normal speed, so that they attain magnetic saturation on a comparatively low armature speed, and thereafter no increase of exciting current can add greatly to the density of the magnetic field. As the magnetic field is not intensified, evidently the induced current in the armature coils is not increased, and the capacity of the generator is thus self-limited.

Although the output is thus restricted within safe limits, the armature speed is not, and the bearings of the latter's shaft need to be of substantial design to withstand the severe service required of them. It follows, therefore, that a step in advance would be to limit the armature speed, automatically, to that required to saturate the field magnets, by means of a governor and automatic clutch, or some similar device. This is accomplished in a very simple manner in the machine manufactured by the Motsinger Device Mfg. Co., and called by them the "Auto Sparker." In this machine the field magnets, armature and bearings are pivotally mounted on a sub-base, so that the armature shaft is free to rock in a vertical plane. A small friction pulley on one end of the shaft runs against the lower part of the flywheel rim of the engine, being held in contact therewith, because the pulley end of the shaft is overbalanced by the commutator end, which also carries the automatic governor. The governor balls act on a conical sleeve on the shaft, in such a manner as to cause it to ride upon a correspondingly beveled fixed surface. This lifts the commutator end of the shaft, and causes the pulley on the opposite end to drop out of engagement with the flywheel rim. When the dynamo's speed is sufficiently reduced, the pulley returns to contact again, and the process is repeated.

In any such device the driving member, as the flywheel rim, is necessarily running at a permanently higher speed than the driven member—the friction pulley—and the one is therefore rubbing on the other so long as the two are in contact. This might be thought an unmechanical arrangement, but practically it is not objectionable, as the wearing member can be made so cheaply replaceable as to be a quite insignificant item

# MINOR MENTION

Detroit is to experiment with a gasoline mail collector of the four-wheeled variety.

The Woods' Electric Vehicle Co., of Utah, has been incorporated with a capital of $25,000.

An automobile company is being organized at Davenport, Ia., with a capital of $500,000.

The Stutzman Automobile Co. has been organized in Williamsport, Pa., with a capital of $50,000.

A movement is reported to be on foot in Des Moines, Ia., to operate a line of public motor-vehicles.

The legal speed of automobiles in Paris is 12 miles per hour in the streets and 16 miles per hour on the road.

The electric bus line, which is to operate on Orange street, New Haven, Conn., will begin running in a few days.

An automobile club has been started in San Francisco, and there are said to be fully 50 machines in and about that city.

The initial run of the Buffalo Automobile Club was held on the 8th inst. Eight vehicles participated, and the affair was an unqualified success.

Some admirers of Béconnais lately presented the "roi des motocyclistes" with a souvenir of his performances in the Nice week, in the shape of a handsome gold watch chain.

It is reported that the Bellefontaine carriage factory at Bucyrus, O., which has been closed down for several years past, will be purchased by local capitalists for a motor vehicle plant.

The Overman Automobile Company, which was organized last May with a capital of $250,000, has leased the Ames Foundry Co.'s plant in Chicopee, Mass., and will put 50 men to work at once.

The Jackson & Sharp Co. has completed five electric "carettes," for service in Washington, D.C. They resemble small trolley cars in the form of the body, but are mounted on running gears of the customary form.

The patents of the General Electric Automobile Co. were sold at auction in Philadelphia on July 11th for $29,000, in order to satisfy the claims of creditors. Jas. W. Cunningham, of 41 Wall St., New York, was the purchaser.

The United Power Vehicle Co., of New York, will establish its plant at Rutland, Vt., It will employ about 80 hands at first, and will gradually increase its force. At a city election held for the purpose, it was voted to exempt the company's property from taxation for ten years.

The National Automobile Company has been organized in Philadelphia, and the board of directors instructed to purchase the factory, grounds and machinery of the McLear & Kendall Company. As soon as arrangements are completed, the company will at once begin the manufacture of automobiles of all descriptions under the patents and designs of John H. Parsons.

The Columbia Automobile Club at present numbers four freshmen, four sophomores, one junior and one senior. There was no concerted effort to hold club runs during the spring term, but it is expected that when the College opens again in October the Club will have several new members, and a series of weekly runs is then planned for. It is the wish of the Club to secure a membership of 20, as when it has that number a prominent manufacturer has promised to build a branch storage and charging station on 116th street, near the college, where the members can stable their rigs.

We have received a notable catalogue from the Weber Gas and Gasoline Engine Co., of Kansas City, in which their large line is fully illustrated and described. Aside from their regular shop power engines, this company makes an especial bid for the hoisting and pumping trade, and their engines are found in mines, irrigating ranches in the far West, runnng air compressors, and performing many other unusual classes of work. They have been sold as far away as New Zealand, and they are designed for any fuel from coal gas to crude oil.

It is the intention of Collector Bidwell to institute a locomobile service between the Appraiser's stores and the New York Custom House. This will give a much quicker service than the present cab service. At present two cabs are used to bring the invoices from the Custom House to the Public Stores. By the installation of one locomobile, which will make regular trips to convey the official messenger with the invoices, it is expected a better service will be given. Collector Bidwell, himself, has for some time been using a private locomobile to carry him to and from the Custom House.

Licenses have been granted in Chicago to six women operators of motor vehicles thus far. Miss Julia M. Bracken, the young sculptor, was the first woman in Chicago to apply for a license. No licenses to run steam or gasoline carriages have thus far been granted, neither of the latter being considered safe in the unmechanical hands of feminine drivers. City Electrician Elliott, when asked if a woman qualified to run a locomotive would be permitted to operate a steam carriage, said that she undoubtedly would. As gasoline voiturettes are all the rage among Parisian women, it seems inevitable that the ban will ere long be removed in this country.

The distance from Raymond to Yosemite Valley, by way of Wawona, is 70 miles, with an elevation of 5,000 feet to be overcome. The better part of two days is consumed by the regular stages which make the trip, but the steam carriage driven by Oliver Lippincott and E. Russell made the trip in eight hours and eighteen minutes, actual running time, and on consumption of eight gallons of gasoline.

With one exception the occupants of the vehicle had no difficulty with timid horses on the way. Near the little mining town of Grub Gulch, a four-horse lumber team shied at the unusual object, but the driver is said to have been more to blame than the animals. All other teams encountered on the road and after reaching the valley were quite unconcerned.

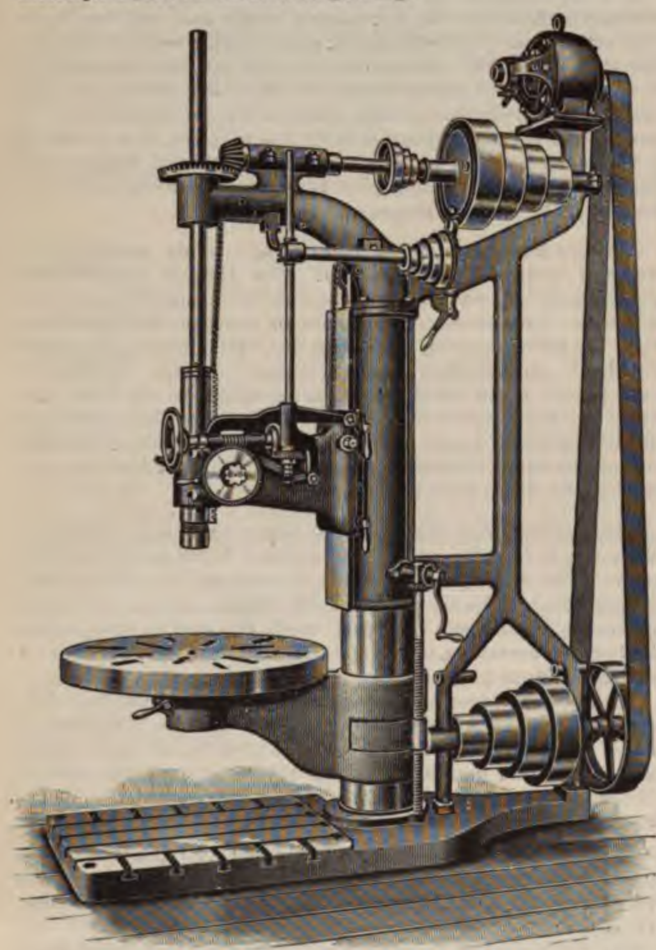
Consul-General Guenther, at Frankfort, in reporting to the State Department at Washington, writes of the business being transacted by an automobile company organized last year. He says:

The "Automobile Co. of Spuyer," organized last year with a capital of $24,000, has five automobiles in use, representing an investment of about $14,500. They are propelled by a benzine motor, in front of the vehicle, of 10-horse power, and were built by the Daimler-Automobile Co., of Cannstadt. Each coach is capable of carrying 28 passengers, and the company has a contract with the Post Office Department to carry the mails (which includes packages, etc., usually sent by express in the United States) to Dudenhofen, Geinsheim, Hohnofen, Hartausen, Mechtersheim, Otterstadt and Waldsee—two to ten miles away. In the five months since starting, more than 40,000 passengers have been carried.

# MACHINERY AND TOOLS FOR MOTOR VEHICLE BUILDERS

### A DRILL PRESS WITH BELT-CONNECTED MOTOR.

The accompanying cut shows a unique way of mounting an electric motor on an upright drilling machine. In using what may be termed a belt-connected motor, not only is the customer saved the expense of gearing, but this method places the motor away from the dust and dirt of the floor, anp requires no extra floor space. Again, the belt is noiseless, and as a transmitter it is just as efficient as gearing.



The W. F. and John Barnes Co., of Rockford, Ill., who build this machine, have furnished several of them to the order of their customers. They are prepared to quote on either geared or belt-connected motors, but for the above reasons they recommend the latter.

---

Parsell and Weed, proprietors of "The Franklin Model Shop," 129-131 W. 31st street, New York, have sent us a circular and price list of the ½-h. p. gas engine, whose construction is described in their book on "Gas Engine Construction," and for which they furnish any parts desired, either in the rough or finished.

# MOTOR VEHICLE PATENTS ∴ ∴ OF THE WORLD ∴ ∴

### UNITED STATES PATENTS.

652,534—Motor Vehicle.—Thomas Croll, of Milwaukee, Wis. June 26, 1900. Application filed March 5, 1900.

The object of this invention is to apply tractive force to all four wheels of a vehicle, while not interfering with the steering. To accomplish this use is made of the fifth wheel, and all four wheels are loosely mounted on solid axles, and are driven by internal gears and pinions from split secondary shafts, carrying differentials, immediately below the axles.

Fig. 1.

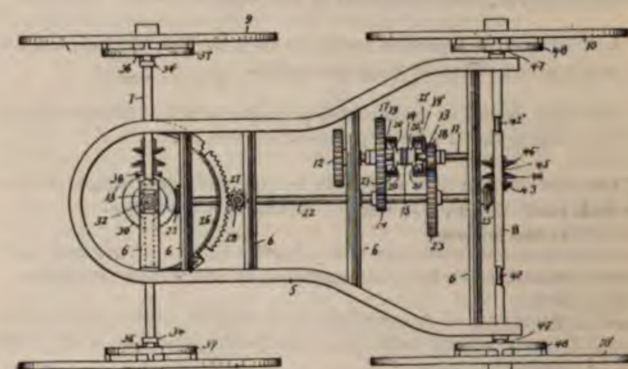
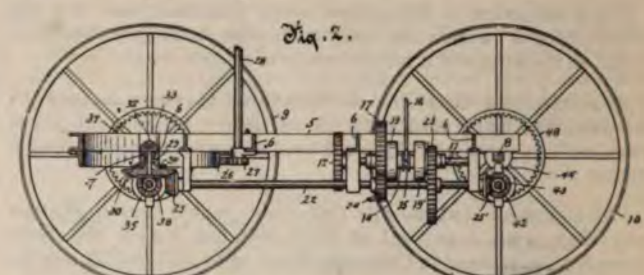


Fig. 2.



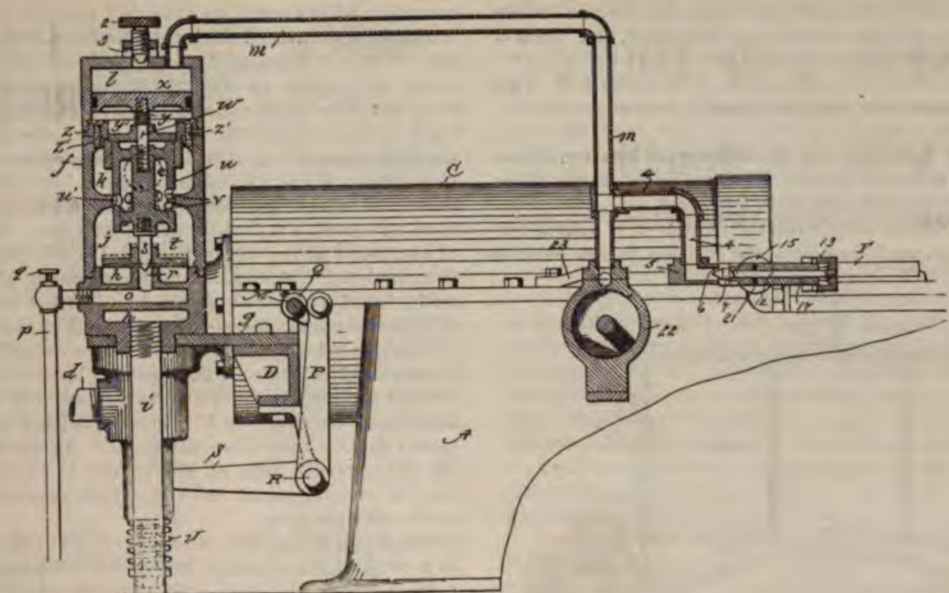
652,534.

From the motor shaft 11 is driven through suitable speed gears a countershaft 22, carrying a bevel pinion at each extremity. The rear pinion drives the differential drum of the rear secondary shaft through a bevel gear in the usual manner. The forward pinion (see Fig. 2) drives a horizontal bevel gear 30, whose axis is in the axis of the fifth wheel; and this gear drives the differential drum on the secondary shaft through another bevel pinion.

Steering is accomplished by the segmental gear and pinion 27. No spring rigging is indicated, and herein the invention appears to be defective.

652,544—Gas Engine.—Chas. A. Miller, of Springfield, O., June 26, 1900. Application filed Feb. 13, 1897.

The leading feature of this invention is the method of governing. The air enters by the pipe i, and passes through the chamber h, around the hollow bridge o, to the mixing chamber j. The gas enters by the pipe p and the passage r, whence it flows to the mixing chamber is governed by the conical valve s. The mingled air and gas go by way of the holes v in the hollow piston in to the chamber k, and thence to the cylinders



652,544.

by the dotted outlet e. The piston is in for the purpose of governing the supply of mixture. To this end it is joined by a stem w to the piston x. A helical spring y tends to keep the pistons up, and air pressure in the chamber l, above piston x, tends to keep them down. The position actually assumed by them, therefore, depends on the degree of pressure in l, and this is regulated by the governor. A pump 22, driven by an eccentric from a suitable shaft, keeps pumping air into the pipe m, which is in communication with the chamber l. An outlet 6, controlled by the valve 7, allows the air to escape; and an increase of speed comes from the governor, acting on this valve, to partly or wholly close it. The pressure in l, under the continued action of the pump, then forces the piston x and u down, and thus wholly or partly covers the perforations v through which the mixture passes, when the engine speed is sufficiently reduced, the outlet 6 is opened and part of the compressed air escapes.

652,648.—Traction Engine.—Frank Sommer, of New York, N. Y., June 26, 1900. Application filed Feb. 1, 1900.

652,669.—Automobile Vehicle.—J. Donovan, of Escanaba, Mich., June 26, 1900. Application filed Sept. 6, 1899.

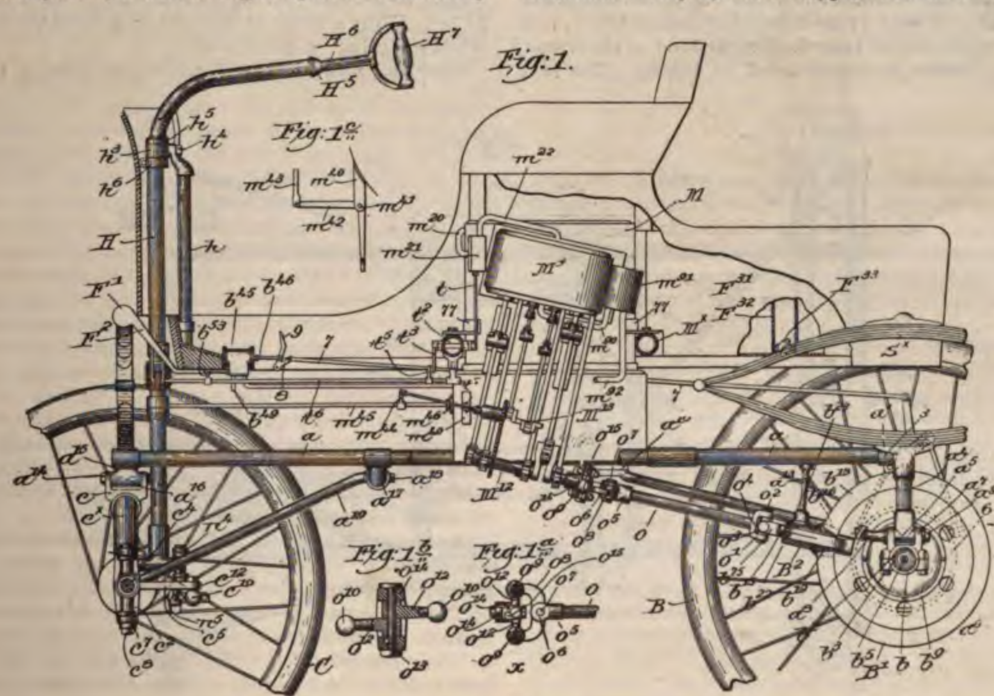
652,673—Motor Vehicle.—Joseph Greffe, of Paris, France. June 26, 1900. Application filed Oct. 13, 1899.

A vehicle of the forecarriage variety.

652,763—Expansible Pulley.—Bion B. Farnham, of New York, N. Y. July 3, 1900. Application filed May 4, 1900.

652,851—Automobile Vehicle.—H. W. Libbey, of Boston, Mass. July 3, 1900. Application filed Oct. 2, 1899.

652,852—Motor Wheel for Vehicles.—H. W. Libbey, of Boston, Mass. July 3, 1900. Application filed Oct. 2, 1899.




652,940.

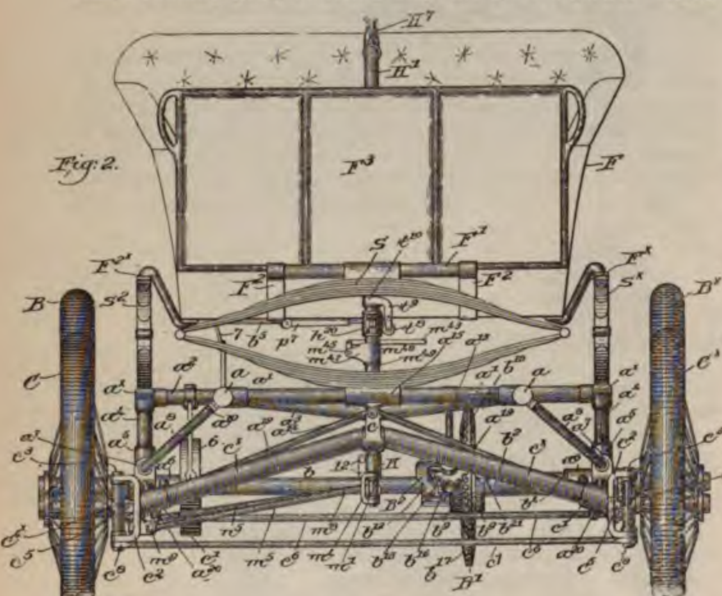
652,890—Pneumatic Tire.—G. H. Clark, of Boston, Mass. assignor to the Clark Cycle Tire Co., of Portland, Me. July 3, 1900. Application filed November 13, 1899.

652,909—Gas Motor.—C. L. Mayhew, of Newark, N. J. July 3, 1900. Application filed June 16, 1899.

Another compound motor.

652,940—Motor Vehicle.—Geo. E. Whitney, of Boston, Mass., assignor to the Whitney Motor Wagon Co., of same place. July 3, 1900. Application filed Jan. 21, 1898.

This invention covers nearly all the details of a steam carriage running gear, omitting only the motive power—engine



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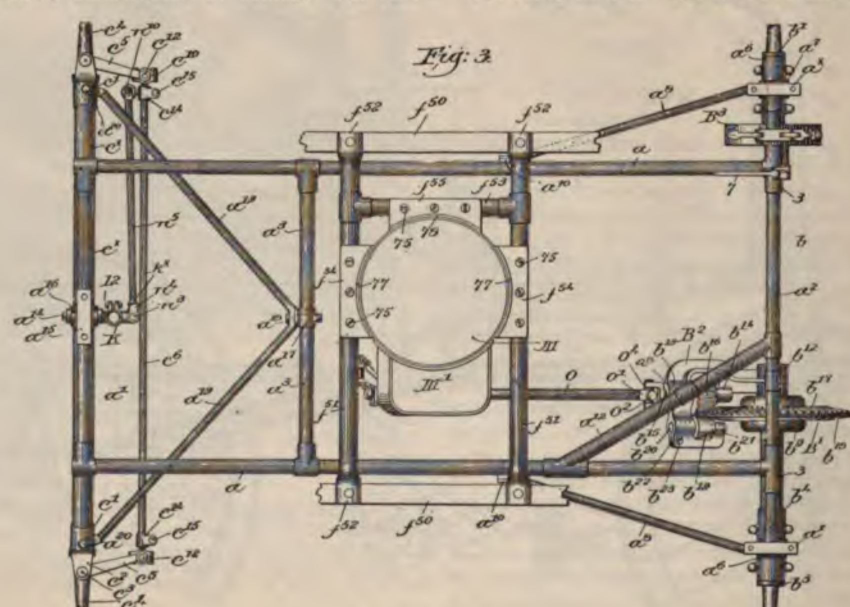
and boiler—itself. There are are 46 claims, and the specifications and claims cover 14 pages. We give below a synopsis of the leading features.

The frame of the vehicle is best shown in Fig. 3, and comprises side bars a, front and rear cross-bars $a^1$ $a^2$, respectively, and an intermediate cross-bar $a^3$ near the forward end of the frame, the frame being preferably constructed of tubing. The rear cross-bar $a^2$ is shown as extended beyond the couplings 3, by which it is connected with the side bars, and at its extremities the cross-bar is secured to forgings $a^4$ (see Fig. 23), which carry the springs on their upper ends, and at their lower ends have bearings $a^6$, for the rear axle, secured to them. The driving axle is divided in the usual manner, the half axle b entering the half axle $b^2$, and each half being connected to one gear of the differential in the usual manner. Shoulders $b^4$ retain the halves in place, and a rod $b^5$, with retaining nuts $b^7$, guards against loss of a wheel by axle breakage. The corner portion of the frame above the differential is additionally braced by a diagonal bar $A^{12}$, Fig. 3, having a hanger $a^{13}$ jointed thereto, and jointed at its lower end to a bracket $B^2$, the joints being of ball-and-socket form. The rear end of the bracket is shaped to provide a bearing $b^{12}$ for the rear axle, adjacent the compensating mechanism, and the bracket is provided with bearings $b^{13}$ $b^{14}$ for a short shaft $b^{15}$, having secured to it between said bearings a bevel-pinion $b^{16}$, in mesh with a gear $b^{17}$ on the adjacent side of the pinion carrier B′. As shown in Figs. 3 and 23, the opposite side of the carrier is beveled, as at $b^{18}$, and travels over a conical roll $b^{19}$, which retains the pinion $b^{16}$ in mesh with its gear.

The down-dropped front axle $c^x$ is pivoted at c, so as to rock in a vertical plane, and is braced by reaches $a^{19}$, joined to it by bolts $a^{20}$ near its ends, and pivoted at $a^{18}$ to rock with the axle. A tie rod $c^7$ connects the ends of the front axle as shown, the whole forming a very stiff yet light construction.

The connections between the lever arms of the steering axles and the steering head are made with ball joints, as shown at $c^{12}$ and $n^{10}$. The steering and controlling handle is made to combine all the functions of steering, throttling the engine, and reversing. The customary lateral swinging movement steers the vehicle, a twist of the handle $H^7$ governs the steam admission, and by a pull on the handle the motor is reversed. As seen in Figs. 1 and 7, a standard h carries ahead $h^1$, within which swivels the bearing $h^2$ of a loose ring $h^3$, within which the steering head H is free to turn. The swiveling of $h^3$ is intended to provide for tipping and rocking of the body. The foot of the head H ends in an inverted T, seen in Fig. 1, whose rear end connects by the pin $n^4$ to the link $n^5$. The front end of the T is connected to a radius bar $m^8$, of substantially the same length as $n^5$, and having its rear end pivoted to one axle stub at $m^9$. Thus a twist of the tube H deflects the tube itself somewhat in acting on the link $n^5$.

Referring now to Fig. 1, the steam goes to the cylinders by



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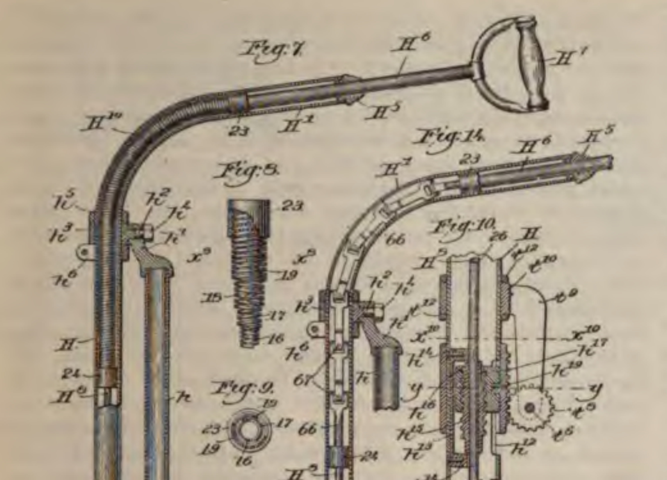


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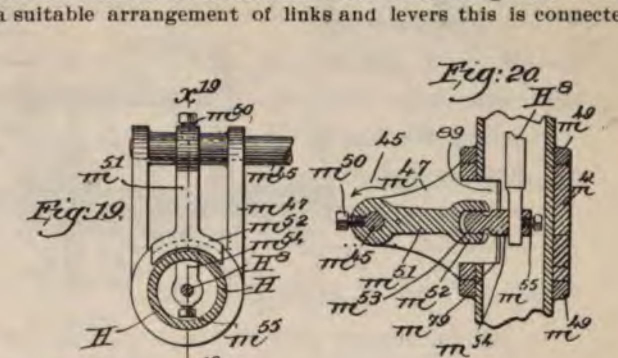
way of the throttle valve $m^{21}$. This valve has its stem textended through the chest $m^{21}$ and jointed to an arm $t'$ of a rock-shaft $t^2$, having its bearings in one of the transverse motor-supports $M^X$, the said rockshaft having also a downturned arm, $t^3$, connected, by a link, with an arm $t^5$ on a long shaft $t^6$, having at its outer end a pinion $t^8$, fast thereon, the shaft passing through the divided supporting arm $t^9$, (see Fig. 10), depending from a collar $t^{10}$, through which the steering-head H passes loosely, retaininng rings $t^{12}$ being secured to the head above and below the collar $t^{10}$, to prevent vertical movement of the collar relatively to the steering-head, the pinion $t^8$ being shown as fast on the shaft between the parts of the supporting arm $t^9$. The steering-head opposite the pinion $t^8$ is cut away at one side, as at $h^{12}$, and inside of the head, as shown in Fig. 10, is secured a plate $h^{13}$, having inturned ends $h^{14}$, which are recessed at their outer ends to partially embrace a shaft $H^8$, extended part way through the straight portion of the steering head H, and concentric therewith. The parts $h^{14}$ form upper and lower bearings for an exteriorly and coarsely threaded sleeve $h^{15}$ (shown separately in Fig. 13), the shaft $H^8$, passing through the sleeve, being longitudinally movable therein, but connected to said sleeve $h^{15}$, to rotate it by means of a spline or key 25, Figs. 11 and 12, entering a suitable longitudinal key way or groove 26 in the shaft. The threaded sleeve $h^{15}$ passes through and engages the similarly-threaded opening $h^{16}$ of a substantially-cylindrical block $h^{17}$, which is elongated at one side, as at $h^{18}$, Fig. 12, to extend into and be guided by the opening $h^{12}$ in the steering-head. The part of the block extended through the opening in the head is shown herein as provided with a recess to receive a lug $h^{19}$ on a two-part collar $h^{20}$ $h^{21}$, which loosely surrounds the steering-head, and on the part $h^{21}$ of the collar are formed a series of long-curved rack-teeth $h^{22}$, with which the teeth of the pinion $t^8$ mesh. Now if through rotation of the shaft $H^8$, the threaded sleeve $h^{15}$ is rotated in one or the other direction, the block $h^{16}$ will be raised or lowered, and thereby the segmental rack-teeth $h^{22}$ will be raised or lowered to rotate the pinion $t^8$ in one direction or the other. Such rotative movement of the pinion, more or less rotates the shaft $t^6$, though the connections described operate the throttle. The long rack-teeth provide for continuous engagement with the pinion $t^8$ when the steering-head is partially rotated, and the collar $h^{20}$ $h^{21}$ is made in two parts for greater convenience and ease in assembling the various members of the mechanism. When the shaft $H^8$ is moved longitudinally, the threaded sleeve $h^{15}$ will not be rotated, and consequently the vertical position of the block $h^{16}$ will not be altered.

The end of the overhanging arm H' is provided with a bearing-cap $H^5$ for a rotatable and longitudinally-movable shaft or rod $H^6$, provided with a suitable handhold or grip $H^7$, the inner end of the member $H^6$ having an enlargement 23 to fit the interior of the overhanging arm, and to guide said member $H^6$ in its rotative or longitudinal movement. Between the member $H^6$ and the upper end of the shaft $H^8$ is interposed a flexible connection which will conform to the curvature of the steering-head, while it will transmit rotative or longitudinal movement of the member $H^6$ to the shaft $H^8$. In Fig. 7 the connection is shown as a flexible shaft $H^{10}$, attached at its ends to the slide-rod $H^6$ and the shaft $H^8$, respectively, said flexible shaft being composed of a series of conical spirals wound in opposite directions, and, as best shown in Figs. 8 and 9, four such spirals are shown.

It is convenient to provide means for automatically applying the brake when the steam is shut off from the motor, and to effect this, a brake-controlling cylinder $b^{45}$ is mounted on the vehicle-body, Figs. 1 and 7, connecting the piston thereof by a rod $b^{46}$ with the foot-actuated brake-controlling lever 9. By a suitable arrangement of links and levers this is connected

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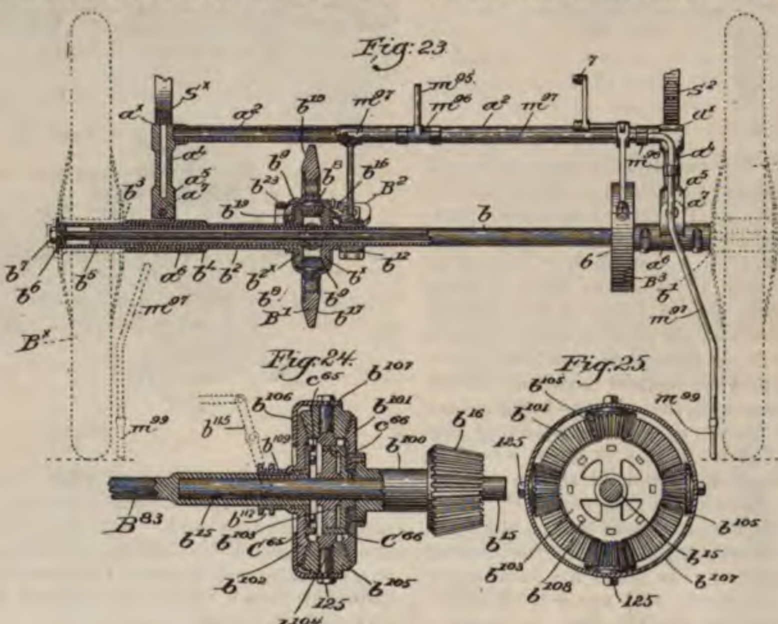
with the throttle rock-shaft $t^6$, so that when the latter is rotated in the proper direction to shut off the steam from the motor, the valve-rod $b^{50}$ will be moved to admit steam to the brake-cylinder $b^{45}$, to thereby set the brake, and when the rock-shaft $t^6$ is turned to open the throttle, the valve-stem $b^{50}$ is moved to permit the escape of steam from the brake-cylinder, to thereby release the brake.

In Fig. 14 is shown a modified form of flexible connection between the slide-rod $H^6$ and the shaft $H^8$, said connection comprising a series of links 66, connected to each other by gimbal-joints at 67, to permit the rotative movement of said connection, and also the adaptation thereof to the curvature of the steering-head, the end links of the connection being attached, respectively, to the slide-rod $H^6$ and shaft $H^8$.

The main crank-shaft $M^{12}$ of the motor, Fig. 1, is connected to the valve-shaft $M^{13}$, and by means of a suitable device—such, for instance, as shown in the United States Patent No. 478,022, dated June 28, 1892—the direction of rotation of the main and valve shafts will be reversed. A bracket $m^{40}$ is shown as mounted on the lower portion of the boiler and has fulcrumed thereon at $m^{41}$ a bell crank lever $m^{42}$, one arm of which is connected with the reversing device for the motor, the other arm being connected by a link $m^{43}$ with a rocker-arm $m^{44}$ on a rock-

shaft $m^{45}$, supported at one end in a bearing $m^{46}$ on the boiler, as shown in Fig. 1, the other end of the rock-shaft having its bearings in ears $m^{47}$ (see Fig. 20), forming part of a collar $m^{48}$, loosely surrounding the steering-head below the bottom of the vehicle-body, and held in place thereon by retaining rings $m^{49}$, suitably secured to the head. The ears $m^{47}$ project laterally from the head, as clearly shown in Fig. 2, and between said ears is fixedly mounted on the rock-shaft, as by a set screw $m^{50}$, Fig. 20, a rocker-arm $m^{51}$, having a laterally-extended, segmental and bifurcated end $m^{52}$, Figs. 19 and 20, extended part way into the steering-head through an opening 89 made therein to engage a ball-like portion $m^{53}$ of a sleeve $m^{54}$, rigidly secured to the lower end of the shaft $H^8$ by a suitable set-screw $m^{55}$. The collar $m^{48}$, surrounding the steering-head, is also cut away opposite the opening 89 in the steering-head, to permit free play to the rocker-arm $m^{51}$. Now, when, the slide-rod $H^6$ is drawn outwardly by the operator, the shaft $H^8$ will be lifted, and through the joint between the sleeve $m^{54}$ and the rocker-arm $m^{51}$ the latter will be rocked to turn the shaft $m^{45}$ in the direction of the arrow 45, Fig. 20. By reason of the extended, bifurcated end of the rocker-arm $m^{51}$, the rounded portion of the sleeve $m^{53}$ will at all times remain in engagement with the segmental portion $m^{52}$, no matter how much or how little the steering-head may be turned on its vertical axis in the steering of the vehicle.

The outward movement of the slide-rod $H^6$, hereinbefore referred to, will, through the intervening connections, reverse the direction of rotation of the motor, the normal or "go-ahead" position of the slide-rod being shown in Figs. 1 and 7. the shaft $B^{83}$ being connected to the motor in place of the shaft o, Fig. 1, or it may be connected with the rear end of the latter shaft by a joint. A spider $b^{103}$ is rotatably mounted on shaft $b^{15}$, between the bevel-gears $b^{101}$ and $^{102}$, said spider, as herein shown, carrying studs $b^{104}$, four in number, on each of which is rotatably mounted a bevel-pinion $b^{105}$. A disk $b^{106}$, adjacent the back of the gear $b^{102}$, has an annular flange $b^{107}$, which passes around the outer ends of the pinions $b^{105}$, the studs $b^{104}$ extending through the flange, the latter being secured thereto by suitable bolts 125, so that when the gear $b^{102}$ is moved longitudinally of the shaft $B^{83}$ the disk, spider, and pinions will move in unison therewith. The hub of the bevel-gear $b^{102}$ is enlarged interiorly to receive the hub of a clutch member $C^{65}$, surrounding the hollow end of and attached to the shaft $B^{83}$ in suitable manner to rotate therewith, said clutch member having a series of projections $c^{65}$ on its inner face. A second clutch member $C^{66}$ is secured to the shaft $b^{15}$, between the spider and the gear $b^{101}$, said member having inturned projections $c^{66}$, which enter correspondingly-located holes $b^{108}$ in the spider $b^{103}$, the holes and the projections on the two clutch members being located in like circles on the respective parts. Now, with the parts in position shown in Fig. 24, rotation of the shaft $B^{83}$ carries the bevel-gear $b^{102}$ around with it, causing axial rotation of the pinions $b^{105}$ on their studs, and as the fixed bevel-gear $b^{101}$ meshes with said pinions, they will cause the spider $b^{103}$ to rotate at one-half the speed of the shaft $B^{83}$. Through the clutch member $C^{66}$ the spider transmits its rotation to the shaft $b^{15}$ and at the same speed, so that differential speed of shafts $B^{83}$ and $b^{15}$ is effected.

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A sort of lazy tongs connection is provided between the shaft o and the motor shaft, with the purpose of allowing longitudinal relative motion between the motor and the gears on the axle.

In Fig. 24 is shown a reducing gear, as introduced into and forming a part of the power-transmitting connections between the motor and the driving axle of the vehicle, shaft o, Fig. 1, being shortened to admit the introduction of the said device between the pinion $b^{16}$ and the joint connecting its shaft $b^{15}$ with shaft o. Referring to Fig. 24, the shaft $b^{15}$ is shown as made longer than in Fig. 1, passing through a bearing $b^{100}$, which may form a part of or be attached to the bracket $B^2$, a bevel-gear $b^{101}$ being rigidly secured to the said bearing $b^{100}$. A similar gear $b^{102}$ is keyed to a shaft $B^{83}$, which latter is shown as cored out to receive the end of the pinion-shaft $b^{15}$,

If, however, the gear $b^{102}$ is moved on the shaft $B^{83}$ to the left Fig. 24, the pinions $b^{105}$ will be disengaged from the fixed gear, $b^{101}$ and the spider will be moved toward the clutch member $C^{65}$ until the projections $c^{65}$ thereof enter the holes $b^{108}$ of the spider. Such movement of the spider will not disconnect it from the clutch member $C^{66}$ because of the length of the projections $c^{66}$, and thus the spider acts to connect said two clutch members, and they will rotate together and at the same speed. It therefore follows that the shafts $B^{83}$ and $b^{15}$ will rotate together, and at the same speed, each clutch member being connected to rotate with its particular clutch member, as described. The hub $b^{109}$ of the bevelgear $b^{102}$ is shown, as provided, with an annular groove $b^{112}$, to receive lugs on a controlling-lever, as $b^{115}$, or other device, by which the mechanism may be controlled by the occupant of the vehicle.

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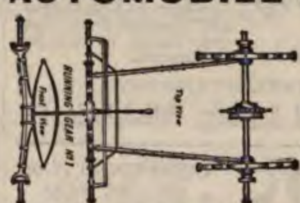

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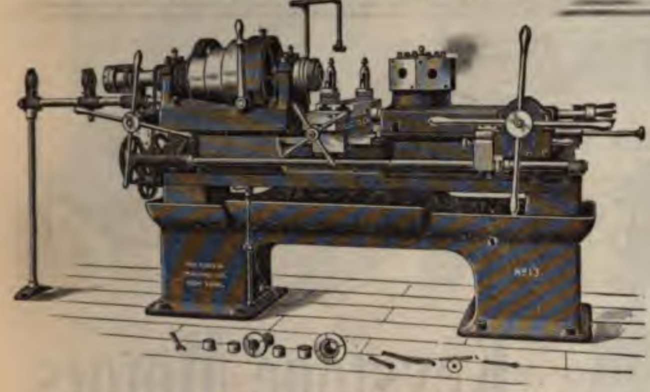

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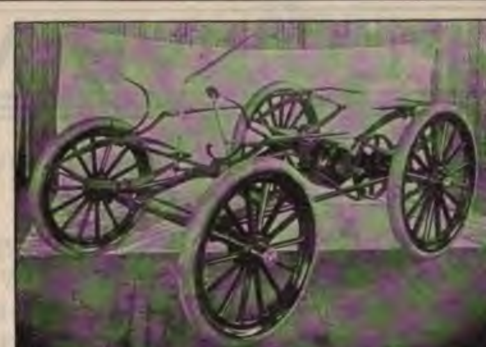

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# THE HORSELESS AGE

...EVERY WEDNESDAY...

Devoted to Motor Interests

VOLUME VI NEW YORK, JULY 25, 1900 NUMBER 17

## THE HORSELESS AGE.

E. P. INGERSOLL, EDITOR AND PROPRIETOR.

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## CO-OPERATION NEEDED.

THE programs issued by the committee of the Ranelagh Club, for the "automobile gymkhana," which was noticed in our last issue, contained one paragraph which should find a place in the program of every similar meet of motor vehicles. This was an announcement stating that during specified morning hours, before the contests began, members of the Club could bring their horses to the Club grounds to have them trained in the presence of motor vehicles sent there for that purpose.

A timid horse, suddenly confronted by the unaccustomed sight of a motor vehicle, is a source of danger to its owner, a nuisance to the motorist, and not seldom an alarming menace to the public. It is to the interest of all parties to dispel the animal's apprehension as promptly as possible, and experience has shown that in no way can this be better accomplished than by giving him an opportunity of walking quietly up to the machine and investigating it. If the vehicle leaves him frightened the first time he sees it, he is likely to be more frightened the second time, and it will take several encounters of this sort to convince him that he is not in danger. If, on the other hand, he has a chance to acquaint himself with the uncanny thing, first standing and then in motion, that is likely to be the end of it, so far, at least, as any real danger of a runaway goes. The owner of the machine has then done his duty and the owner of the horse has done his. The latter has removed the danger which might have threatened himself and others, and the former has escaped the public odium which attaches itself to the provokers of runaways of this class.

This is not saying whether the legal responsibility for these accidents should rest with the horse owner or the motor vehicle owner. That, it seems to us, is after all a subordinate question. The leading fact is that some horses, happily not a majority, but certain timid or fractious individuals, are liable to bolt when they see an automobile. They cannot forthwith be shot, and the next best thing is to train them to face the machines. Their owners are duty-bound to accomplish this with the least peril to themselves and to the public, and the owners of motor vehicles should help rather than hinder them to the extent of their ability.

This co-operation should not be confined to exhibition meets. Every owner of an automobile should be ready to stop when requested to do so, or even without waiting to be asked, when a horse appears to be uneasy at sight of his vehicle. Every driver of a restive horse, instead of trying to avoid the automobiles, which he is certain to meet in increasing numbers, should make the most of every opportunity of accustoming his beast to them. It is a mistake to stop the horse and run the machine up to him, striking him with the whip and "jerking" him to make him stand still. Such a procedure tells the horse as plainly as words that he is expected to be frightened. The machine should always be stopped, and the horse should be led up to it by the bridle. If he is given his time, and perhaps walked round the machine once or twice in case he is unusually timid, the result will seldom be a failure.

Some motor vehicle owners in England, who deserve the thanks of their community for the public spirit which they have shown, have published their willingness to allow any horse owners who so desire to train their animals in the presence of their vehicles and on their grounds. It will not always, perhaps not often, be possible for others to emulate this example; but those automobilists who would object to giving

such co-operation as they are able, of this and other sorts, merely on account of the personal inconvenience involved, would do well to remember that the popular animus, which so frequently finds expression in irrational and oppressive speed regulations, is in large measure caused by the lack of consideration too often shown by motor-vehicle drivers when passing horses. The horses will get used to it some time, but it will be much better for all concerned if the crisis is passed without leaving the country-side blanketed with six-mile speed limits.

## SHOUTING FOR GOOD ROADS.

WE reprint in another column some extracts from a recent editorial in our contemporary, *The Engineer*, on the subject of motor vehicle design. In the main these remarks may be allowed to pass, though we fancy that many of our readers will not be slow to pick holes in them. Those passages about the powering of vehicles, in particular, strike us as rather over-due. No one, to-day, thinks of putting less than five or six horse-power into a gasoline carriage for general use, and the tendency in this country is to make it even higher. Nor is it true, on the other hand, that the number of light carriages ("voiturettes") is decreasing. On the contrary, the number of these vehicles in France and on the Continent, where the roads are good, is keeping pace with the increase of power in the heavier and faster vehicles. They have a field of their own, very similar to that of the electric pleasure carriage, and they fill it admirably.

But at one point our contemporary's utterances are so entirely beside the real issue that we cannot quote them without criticism. We refer to its remark to the effect that "it is a bad sign that the motor-car man shouts for the improvement of the roads. It is as though he was driven to admit that he could not devise a vehicle which works satisfactorily on roads as they are."

It is quite true that motor vehicle men shout for good roads, and it is also true that they will continue to shout for them until they get them. They would do this, were they ever so successful in building machines that would navigate these roads without being wrecked. But are the builders of vehicles the only ones who would like to see the roads made better? Admittedly the constructional problem is greatly complicated by the miscellaneous sprinkling of cobblestones, ruts, mud holes, and what not else, in what we are pleased to call our highways; but is there nothing in all this hullaballoo for good roads, at which *The Engineer* sniffs so easily, save a thrifty concern for the repair bill? Did the editor who penned the above-quoted fling never detect himself picking out the smooth part of the road when taking a spin awheel, or selecting a smooth road to a given destination in preference to a rough one? And when he did (for a negative answer is inconceivable), was it for nothing but a fear lest his wheel should be shaken to pieces? In other words, have not the users of vehicles also a preference in the matter?

The wear and tear incident to locomotion on a rough instead of a smooth surface constitutes only one of the objections to bad roads. Another, of even greater importance, is the tax which they levy in the shape of increased power required to propel the vehicle; and a third is the absolute limit soon reached in the way of speed.

We need not mention asphalt pavements in this connection, though they unquestionably pay for themselves in cities; but the dirt roads, surface-dressed or not dressed at all, which constitute almost the sole avenues for local transport outside of the populated centres, are an enormous and perennial drain on the resources of the community. As between the traction required to haul a given load on good macadam, laid as the inventor of that pavement intended it should be laid, and not reduced to a top-dressing of stone rolled into the dirt, and the traction required by the same load on country roads of only ordinary badness, the later is found to be treble or quadruple the former, or even more. We have lately seen the statement that in the State of Maryland alone the increased cost of haulage over the existing roads, beyond what would be required on macadam, amounts to $3,000,000 a year. For the farmer this means just so many more horses to be cared for; and more wagons also, on account of the longer time consumed in performing a given haul. For the user of motor traction it means, first, a more powerful motor to propel the vehicle; then added weight in the running gear to carry the heavier motor; then more weight in the motor to propel the added dead weight; and, finally, a more massive, more costly, and less easy-riding construction all around.

The economic loss in the way of reduced speed, material even with horse traction, becomes far weightier when mechanical propulsion is employed. There are strict and well-known limits to what a horse can do in the way of speed, even on the best of roads. Ten miles an hour and 50 miles in a day is, roughly, the limit of what can reasonably be expected; and the roads must have been exceptional if the animal can repeat this without injury on the following day. But the motor vehicle is under no such limitation. Given a good road, the speed mechanically possible is far in excess of what is usually compatible with public safety. The safe speed for given conditions of traffic will be governed by the controllability and braking power of the vehicle, and will be in excess of that considered safe with horses in proportion as the motor vehicle is better controlled than the horse. We already know that the former is far ahead of the latter, and it is reasonable to suppose that we have not yet reached the end of what is possible in this respect. The ultimate tendency, then, will be for speed limits to go up, and to go up very considerably. We may even expect to see reckless driving differently defined, as regards speed, according to whether the vehicle is propelled by a horse or a motor.

The conditions are therefore ripe for what will in time become a veritable revolution in the speed of transport on our highways. The faithful equine has so long been the be-all and end-all of our ideas in this field that it will take a little time for us to forget that we are no longer tied down by his limitations. The evidence already at hand shows that in every department, from trucking to racing, his speed can be at least doubled. Not only is it possible to do this, but the higher speeds are more economical, in time saved and equipment reduced. The one great thing needful to accomplish the change is good roads—good roads everywhere that a wagon or a car-

riage is expected to go. Economically of advantage even for horse traction, they will be provided liberally when it becomes evident that only their absence stands in the way of the revolution which the motor vehicle is able to bring to pass. The argument of the dollars will settle it, in spite of legislative inertia or popular misconception. It is as idle to say that, because horses can travel only so fast, motor vehicle users should be content to do the same, as it would have been, in the days before roads were opened and when men used oxen, to deride those progressive individuals who wanted to lay roads and use horses. An improvement whose advantage is demonstrated takes a lot of beating; and nothing is more certain than that good roads belong in this class. They will come.

## THE SILLY SEASON IN URBANA.

THE City Council of Urbana, O., is discussing an ordinance limiting the speed of motor vehicles in that town to four miles an hour, and requiring that all such vehicles shall be equipped with a bell or gong, and the same shall be sounded when within 50 feet of a crossing, and kept sounding until after the crossing is passed. The ordinance also requires lamps to be placed on the front end of the machine, and for failure to comply with the above conditions a fine of not less than $5 or more than $50 is to be imposed.

Where is the sense in enacting speed legislation of such a sort that it is certain to be repealed and made over within a few months? It is evident that the Solons of Urbana know nothing about the vehicles they are so anxious to "regulate," and apparently they are not in a hurry to learn. We think we see the citizens of Urbana buying automobiles to meander within its borders at four miles an hour!

## THE FIRST GUN FIRED.

Suit has been brought by the Electric Vehicle Co. and George B. Selden against the Winton Motor Carriage Co. for alleged infringement of the now famous Selden patent. Betts, Betts, Sheffield & Betts are counsel for the complainants, and the case will be tried in the United States Circuit Court of the Southern District of New York, probably some time this fall. The defendants have retained counsel in New York and also in Washington, but their names have not yet been announced. The statement in a contemporary that W. B. & G. F. Chamberlin, of 31 Nassau street, New York, are the New York counsel is incorrect and is denied by the firm in question. It is reported that action has been commenced also against the Buffalo Motor Co.

## SOME FRENCH RACERS COMING HERE.

W. K. Vanderbilt, Jr.'s, 30 horse-power Daimler racing machine, the first of its kind ever brought to this country, will have some worthy rivals before long. The purchase by Albert C. Bostwick of René de Knyff's Panhard racer, which carried the celebrated Frenchman victoriously through the contests of last year, was recorded in these columns some time ago. Now we are able to announce that four other machines will appear here this Fall. David Wolfe Bishop, Jr., will bring with him a 12-h. p. Panhard. Clarence G. Dinsmore will bring a Mors vehicle, of power not stated; and J. Howard Johnson will have two Mors machines, one of them being of 40 h. p. and built to carry eight people. The last-mentioned vehicle will be the most powerful, and possibly the fastest, yet built in any country.

## THE MADISON SQUARE GARDEN EXHIBITION.

The Automobile Club of America has nearly completed arrangements for the exhibition of motor vehicles and accessories at Madison Square Garden from November 3 to November 10. The committeemen having it in charge are A. R. Shattuck, chairman, No. 11 Broadway; Gen. George Moore Smith, and E. E. Schwarzkopf. The Committee announces that all the floor space of the garden has been rented by intending exhibitors, and it is proposed to utilize some additional space by flooring over the boxes for the exhibition of accessories. One of the features will be a circular track, on which automobiles of all kinds will be shown in motion, and it may be that in the case of some of the lighter vehicles the track will be useful for contests. This part will be under the direction of the technical committee.

An endurance test for motor vehicles is one of the things talked of by the Club—700 or 800 miles being the probable disance to be covered.

## W. K. VANDERBILT, JR., BREAKS A RECORD.

Boston, July 21, 1900.—The best thing in the way of an automobile story which has yet come to light in Boston is that afforded by William K. Vanderbilt, Jr.'s flying trip from Newport to Boston and return on Friday, July 20. It really astonished the natives, and, best of all, it was true. His wonderful Daimler carriage, regarded as a marvel from the newspaper accounts of it, was even more wonderful to those who caught a glimpse of it. They could get no more than a glimpse, for it was disappearing like a flash in the distance before any of them could get a second look. Incidentally Mr. Vanderbilt established a new record over the road between Newport and Boston. General Manager Dwight Neftel, of the Electric Vehicle Co., and George McQuesten, an East Boston lumber dealer, made the trip in one of the company's new runabouts, equipped with a long-distance battery, on a single charge, on Monday, July 2, in five hours and eighteen minutes; but that run, though pretty good for an electric carriage, was nothing to the Vanderbilt achievement.

Mr. Vanderbilt left his stable at Newport at 6.30 a. m., and arrived in Boston shortly before 9 o'clock, making the run of 72 miles in two hours and eighteen minutes, at a rate of speed averaging 31.3 miles an hour, or a mile in less than two minutes.

In Fall River there are three miles of very sandy road, over which the machine could not make its usual speed, but the delay in this place was compensated for in the run into Boston. On Blue Hill avenue the speed register attached to the machine showed 65 miles an hour. As there is not much road about Boston adapted to such high speed, the run into the city proper was probably at a speed below 20 miles an hour.

Mr. Vanderbilt's run to Boston was merely a pleasure trip, and he stopped here not more than an hour. While in the city he remained at the headquarters of the New England Electric Vehicle Company on Tremont street, and as soon as the gasoline tanks were refilled and the tires inflated, he started on the return trip, with the expectation of reaching Newport in time for luncheon, if he did not conclude to continue over the road to New York With Mr. Vanderbilt was his *chauffeur*, whom he brought with the machine from France. This *chauffeur* holds a first-class unrestricted license in France to run anywhere at any speed. When mounted upon the machine prepared for a run, the two men looked as if they expected to meet a rain or dust storm, but in reality they were taking only the usual precautions adopted for fast automobile driving. Both men wore visored caps, something after the style of a yachting cap; heavy coats buttoned up to the throat, gantlet gloves, and goggles over the eyes. From the sloping dasher a white rubber boot was buttoned up under the arms of the men. This boot, with the dasher, serves to cut through the air and to throw it above the heads of the passengers. After running slowly down the incline, from the automobile company's station to Tremont street, the

machine was headed south and was off in a flash, disappearing almost before one could realize that it had started.

This machine of Mr. Vanderbilt's is, perhaps, the most interesting racing carriage in the country. There is said to be only one other that equals it in speed in the world, and that is owned by a French count. Mr. Vanderbilt bought his in France at an original cost, it is said, of between $5,000 and $6,000; and up to date, the total cost is probably not far from $10,000, for the owner has no regard for expense, and if he wants to stop quickly he does not hesitate to strip off a pair of tires.

Furthermore, if the police of Newport enforce the speed law, Mr. Vanderbilt will probably have an additional expense of $10 to $20 a day for fines, and he has told the police that they have the privilege of arresting him as often as they wish. The carriage has engines of between thirty and thirty-five horsepower. The wheels have French inner-tube tires, three inches in diameter on front, and five inches on the rear wheels. Extra tires are always carried on the box behind. When running at top speed the machine can be stopped within 100 yards without injury. It has five different brakes, and by reversing the engine the wheels can be locked. When this is done, however, it is necessary to have a new set of tires all ready to put on. The fly-wheel of the engine acts as a fan, and draws air from the front of the carriage through ducts. This air passing through at great speed cools the water radiator. It is this air, also, that is the principal cause of the great cloud of dust which surrounds the machine when it is on the road. The exhaust from the engines and the whirling wheels add to the cloud. When the machine was imported it was painted white. Now Mr. Vanderbilt has had it painted crimson and black.

## THE "LOCOMOBILE" COMPANY OF THE PACIFIC.

This company has been organized recently to handle the "Locomobile" on the Pacific Coast. Mr. C. C. Moore, president, is an eminent engineer and automobile expert. The temporary headquarters of the company is No. 32 First street, San Francisco, Cal. The territory which this company will handle consists of the following states: California, Oregon, Washington, Montana, Nevada, Utah, Arizona and New Mexico.

## AUTOMOBILISM AT THE PARIS EXPOSITION.--III.

By P. M. Heldt.

Mme. Veuve L. Longuemare, whose carbureter was described in The Horseless Age some time ago, has an exhibit, both at the Champ de Mars and at Vincennes. Besides carbureters she shows gasoline tanks for motor tricycles and kerosene burners for boilers.

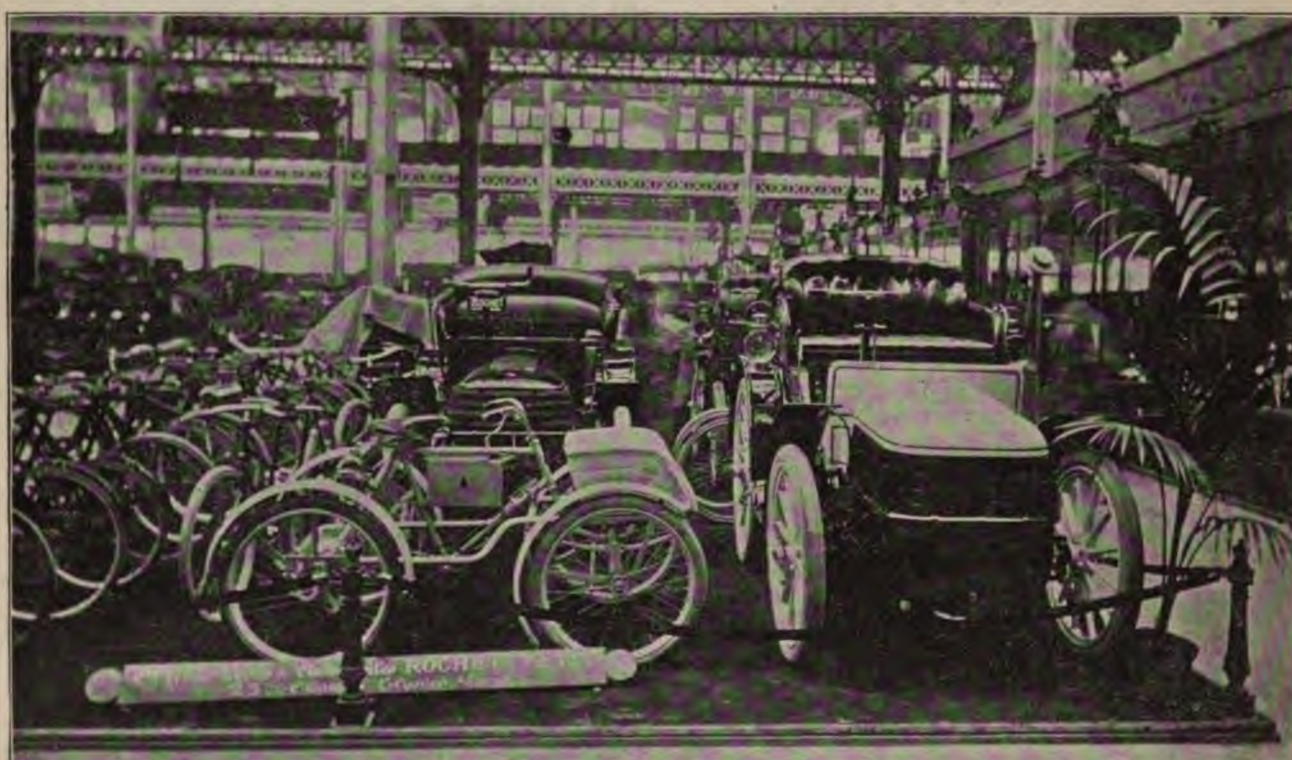
The radiator, shown herewith, consists of copper tubes, on which are loosely slid radiating flanges of sheet copper. The eight tubes of the radiator are flanged into the collectors of sheet steel. After the radiator has been assembled, it is immersed in a bath of molten tin, to insure a perfect adherence of parts. Finally it is enameled and baked.

The plates closing the collectors are easily dismounted, thus facilitating cleaning and repairs. They are provided with plugs for emptying the radiator, and with nipples for the connections. In the following are given some dimensions of construction:

Number of flanges per inch of length, 38. Diameter of the flanges, 1.8 inches. Dimensions of collector, 8¼ inches x 4¼ inches. Length of tube necessary per h. p., 5 to 5½ feet.

Fig. 2 shows the kerosene burner. This apparatus consists of a burner proper, and a vaporizer. It should be supplied from a reservoir containing ordinary kerosene, under an air pressure of from 7 to 28 pounds per square inch. The kerosene arrives by the pipe a, and passes through a coil of pipe around the flame. The heat which is imparted to it here vaporizes it, and it now flows in the form of vapor to the orifices of the burner. Burners are made with one, two and seven flames, the last being the one here illustrated. It will burn about two gallons of kerosene per hour, and as one gallon of kerosene will produce about 40 pounds of super-heated steam, at 100 pounds pressure to the square inch, the production of this burner would be about 80 pounds per hour.

Fig. 3 shows the method of connecting the Longuemare car-



Rochet Gasoline Vehicles.

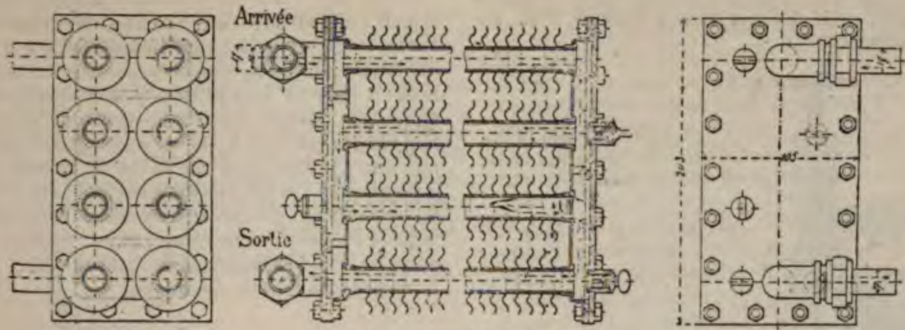



FIG. 1.—LONGUEMARE RADIATOR.

bureter to tricycles. The gasoline reservoir is connected by a pipe a, to the constant level compartment of the carbureter. The valve k permits the shutting off of the gasoline. The air for the carbureter is gathered from between the cooling flanges of the engine, by means of a bell or funnel h, which connects to the carbureter by means of tube g. The exhaust is branched off to the carbureter reheating chamber by tube c, which is provided with a conical valve d, by means of which the amount of burned gas, or in other words, the amount of heat admitted to the reheating chamber, can be regulated. The tube l connects the carbureter to the intake valve, m and n are two rods, by means of which the two leavers T and S are operated. By lever S the mixture is varied, and by lever T the admission to the cylinder is regulated. By means of a piece b, the carbureter is fastened to the tubes of the tricycle.

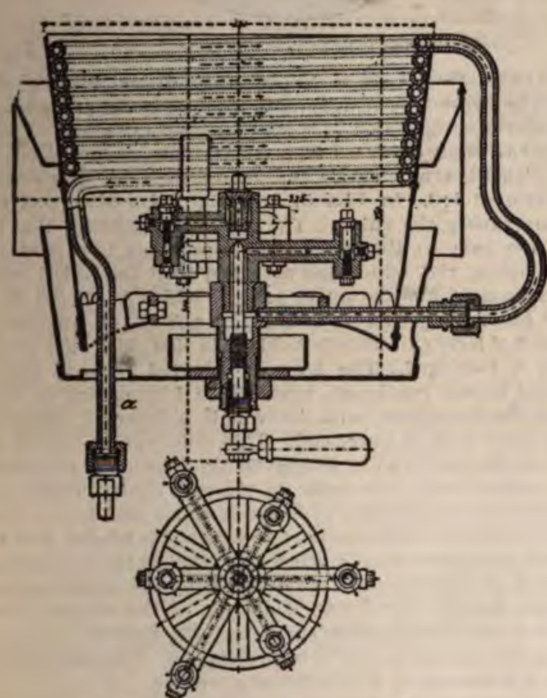


FIG. 2.—LONGUEMARE KEROSENE BURNER.

Dalifol & Thomas exhibited two forms of carbureters, which, although rather different in principle, both go by the name of "Abeille." The simpler of the two, shown in Fig. 4, consists of a cylindrical body, which carries at its upper part an air intake and has at its lower end an L, for connection to the intake valve. The essential part of this carbureter is a double-seated valve D, which shuts off, at the same time, the air and the gasoline.

The air entering at E is to be drawn through, or around, some heated parts, as in the case of the Longuemare carbureter, just mentioned. Over the tube at E, there is a sleeve, and tube and sleeve are pierced with an equal number of coinciding holes. Through these holes cold air is admitted, which mingles with the hot air. By turning the sleeve around on the tube, the opening of the holes, and consequently the air admitted through them, can be adjusted, and thus the temperature of the air be regulated.

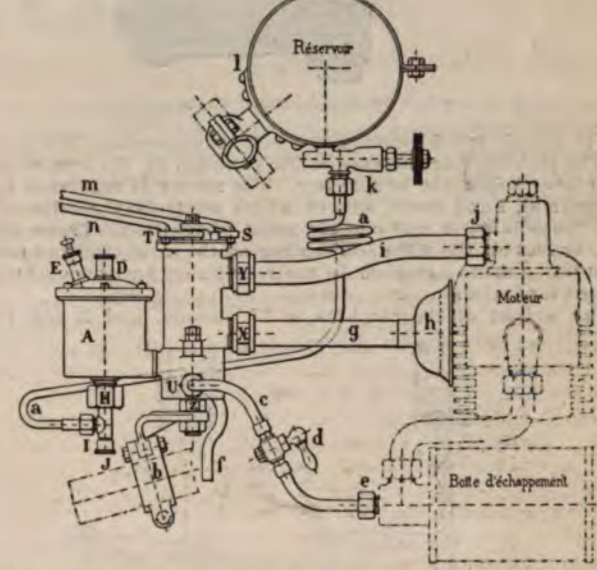



FIG. 3.—PIPE CONNECTIONS, LONGUEMARE CARBURETER TO TRICYCLE MOTOR.

At every suction stroke of the piston, the valve D is lifted off its seats, against the force of the spring on its rod. Air and gasoline are thus admitted. The gasoline enters by pipe B, passes through the needle valve C, and is expanded over the corrugated surface of the valve D. It is instantly evaporated and carried along by the air passing the valve. In the lower part of the carburetor chamber are placed some layers of metal gauze, and the mixture in passing through this gauze is rendered more homogeneous and more perfectly gaseous. On the lower arm, or connection F of the carbureter is placed a sleeve, similar to that at E by means of which the richness of the mixture can be regulated. This sleeve is provided with a lever arm G, and the regulation can be effected when the vehicle is running. The admission of the gasoline is regulated once for by adjusting the needle valve C.

The second carbureter was described in THE HORSELESS AGE of January 10, 1900, and is of the constant level type.

Chapelle & Chevallier show some motor bicycles of a new type, some with variable speed gear and others with a single speed. The same motor is used for both types of wheels. It is air cooled and has a bore of 2½ inches and a stroke of 2.8

inch, being rated at 1½ h. p. The motor crank-case occupies the position ordinarily held by the crank hanger, and the motor is, therefore, placed low.

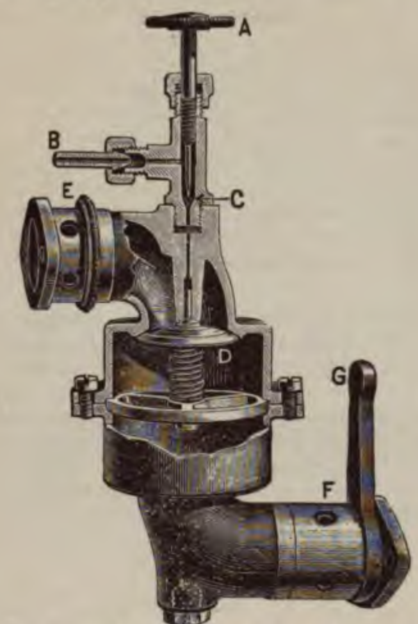



FIG. 4.—ONE OF THE ABEILLE CARBURETERS.

The double speed bicycle has a belt transmission. The belt can be tightened or loosened while running, by the operation of a lever below the handle bar. The motor is regulated by three small hand levers, one of which controls the mixture, one the admission and one the point of ignition. There are two brakes on the wheel, one acting on the front tire, and one on a brake drum attached to the rear hub. An accumulator is used for ignition.

The weight of the machine is 77 pounds, and it can be

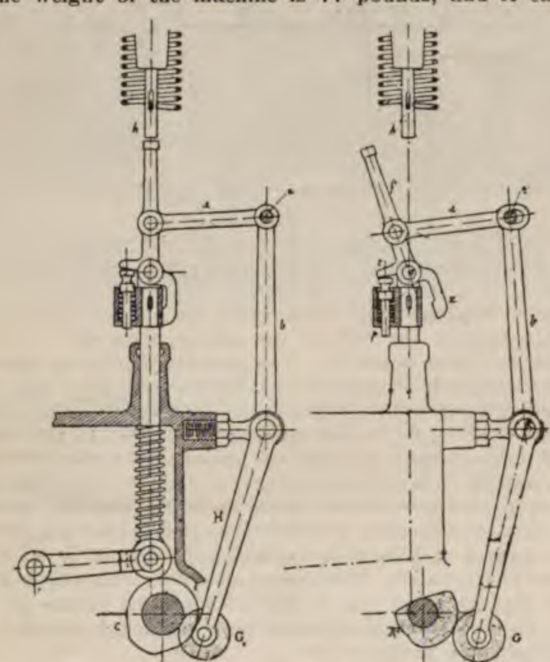


FIG. 5.—VALVE MECHANISM OF ROCHET MOTORS.

geared, according to the wishes of the purchaser, to make from 20 to 30 miles maximum speed on the level. The speed of the motor is from 1,400 to 2,000 revolutions per minute.

There are three automobiles Rochet exhibited at the fair, which are well shown in the photograph.

The Rochet vehicles* are propelled by a double-cylinder vertical motor placed in front. A conical friction clutch, ordinarily held in gear by means of a coiled spring, is placed inside the flywheel. A shaft, running lengthwise of the vehicle, runs into the casing, in which the change gears are located. A shaft running parallel with the latter is geared by means of conical gears to the transverse differential shaft, from which the power is transmitted to the rear wheels. The general layout of the vehicle follows very closely that of the Panhard-Levassor vehicles, and offers therefore nothing new. Some of the details, however, are worth describing.

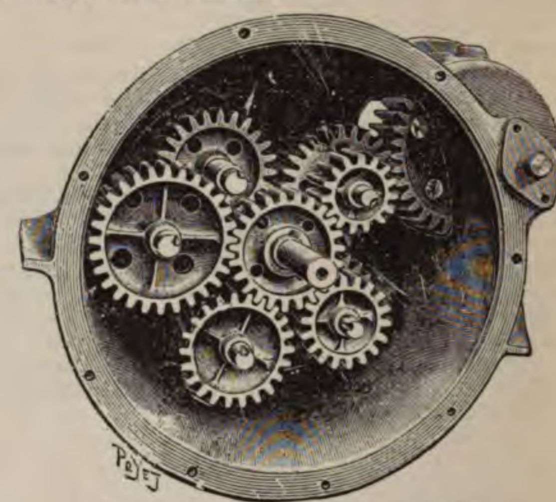


FIG. 6.—ROCHET SPEED-CHANGING GEARS.

The regulation of the motor is on the hit and miss principle. It works first on one cylinder only, and when this is insufficient to keep the speed down, it works on both cylinders. The exhaust valves are operated from a secondary or cam shaft, parallel with the crank shaft, and geared to it by spur gears in the ratio of 1:2. In Fig. 5, k is the valve stem and c the cam operating the valve. The piece transmitting the push from the cam to the valve stem consists of two parts, the lower sliding rod, which has attached to it the roller, rolling on the cam c, and the upper part, f, which is hinged to the lower part. A spring, p, acting through a pin on the projection t of lever f, ordinarily holds it in line with the part to which it is hinged. The lever b, pivoted from a support fastened to the crankcase, connects to f by means of a link d. On the same shaft with lever b is a lever H, which carries a roller G at its lower end. This roller can be moved sideways on its shaft, and by this motion it is brought successively into contact with two cams on the cam shaft. These cams, through the intermediary of levers H and b, and link d, throw lever f out of line with the part to which it is hinged, and thus make it miss valve stem h, when it is lifted by the exhaust cam. The first of the two cams encountered by the roller will only hold the lever p out of line, while one of the exhaust valves wants to be opened, while the other will hold it out of line during the exhaust stroke of both cylinders. The shifting of the roller G is effected by a centrifugal governor.

The change gears of the Rochet vehicle are of a somewhat different order from those usually found in French vehicles. The gear-case with the gears in place is illustrated in Fig. 6. The central gear wheel, the shaft of which is seen protruding, is the driving gear, and is concentric with the motor shaft. It will be seen that there are four gears meshing with it. Each of these four gears is on the same shaft with another gear, placed right beside it and in the same plane with the gear B

* See The HORSELESS AGE, Issue of July 4, pp. 18-20.

(Fig. 6), on the secondary shaft. The various gear wheels are so dimensioned that the wheel B may engage with any one of them, not in mesh with gear A, by rotating the plate to which the shafts of the gears are fastened. For instance, in Figs. 5 and 6 the gear B is shown in mesh with the low-speed gear C, which is on the same shaft with gear K5, engaging with gear A. But if the plate to which the shafts of the intermediate gears are attached be rotated in a counter-clockwise direction, gear B will soon be in mesh with gear C4, which gives the second speed, as C4 is larger than C, and K4 smaller than K5. By still farther rotating the plate we obtain the third and fourth speeds. By rotating the plate in a clockwise direction, the reverse speed is obtained when C is in mesh with B.

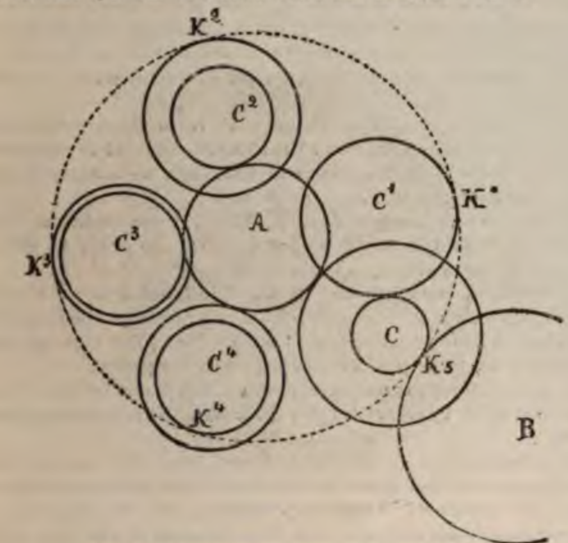



FIG. 6.—DIAGRAM OF ROCHET SPEED GEARS.

In changing gears it is first necessary to uncouple the motor by means of the friction clutch, as otherwise something is liable to break. When the gears are in motion there is a tendency on the part of the plate which supports them to turn, and means have, therefore, to be provided to hold it firmly in place when the gears are in operation. The mechanism shown in Fig. 7 has been designed to meet the last-named requirements.

The plate is held in place by a pawl V, fitting into the notch X. V-T is a double-armed lever, pivoted on the same shaft as lever DE. The pawl is held in the notch by a spring R, fastened to the gearcase. A depression of the rod C would disengage the pawl, but C cannot be depressed directly, but only through the intermediary of the rod A, which is operated by means of the foot lever P. Rod A has a hook, and after the foot lever has moved a certain distance, this hook engages rod C; by a still farther motion of foot lever P, pawl V is disengaged. But the foot lever P also controls the friction clutch, by means of levers L and M and the connecting link, and before the hook on A engages C, the friction clutch is already out of gear.

The plate N is provided with a bevel gear, with which meshes a bevel pinion operated by the speed-changing lever.

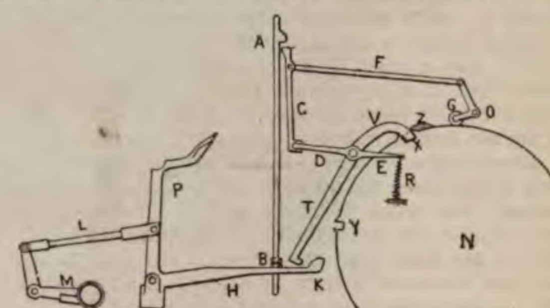



FIG. 7.—ROCHET SPEED-CONTROLLING MECHANISM.

A little protuberance on the circumference of plate N will be noticed at Z. When the roller G of a bell crank, pivoted at O, is on top of this protuberance, the rod C is independent of rod A. The levers T and H now engage each other in such a manner that the lever P, controlling the friction clutch, cannot return until the pawl V is again in a notch. The arrangement is, therefore, perfectly automatic, and even if the operator should take his foot off the pedal P, the friction clutch would not engage until the plate is again firmly locked in place by means of the pawl.

The electric manufacturing firm of Chas. Mildé, Fils & Co.

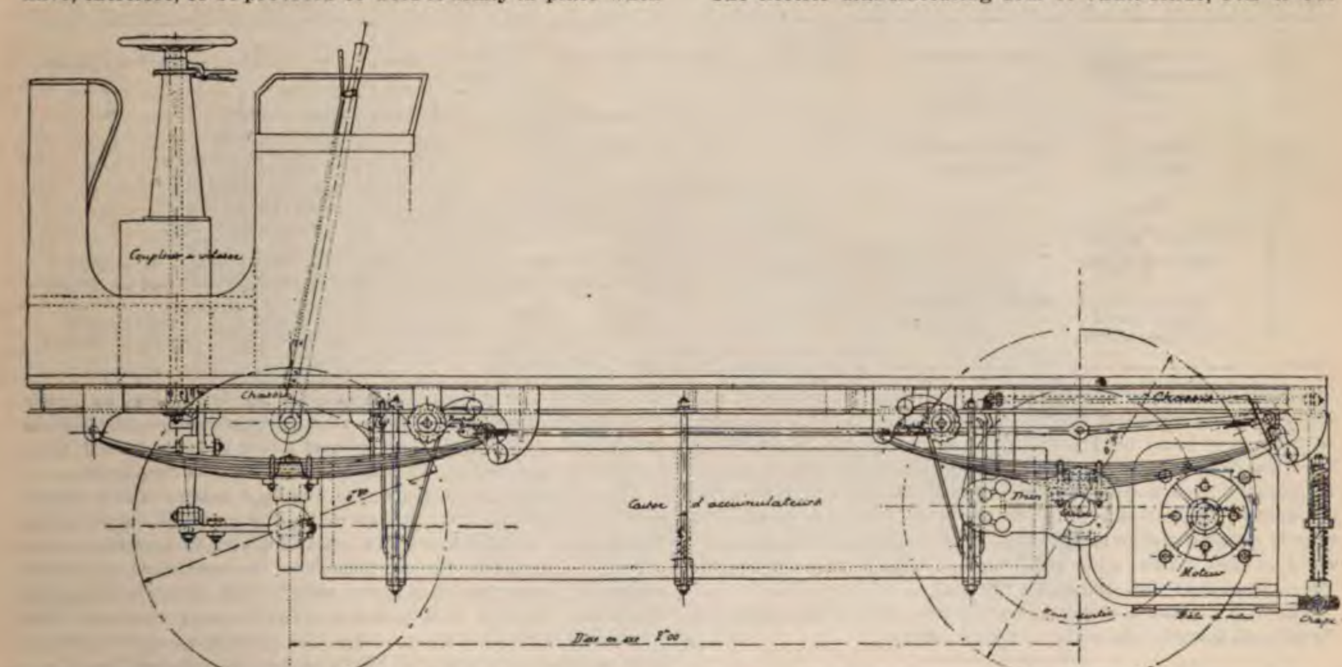



FIG. 8.—MILDÉ ELECTRIC TRUCK.

show three electric vehicles at the exposition, one of which is the electric truck, of which a design is herewith shown. The frame may receive an omnibus, break or delivery wagon body, or a platform for heavy haulage.

The frame is made of U iron, and is supported by four strong semi-elliptic springs. The steering is effected by means of a steering hand wheel, a vertical rod, a bevel pinion, a gear sector, a connecting rod, two steering spindle levers, and a connecting rod between the latter.

The motor has two armatures on independent shafts, revolving in the same field frame, and each working through spur gears on one of the drive wheels. The motor is carried on an oscillating base, pivoted on the rear axle, and suspended from the frame by two coil springs. The gearing is enclosed in a casing, and the ratio of reduction is 1:15. The weight of the motor is 375 pounds, and it has a normal output of 3,800 watts (5 h. p.) at 76 volts and 1,200 revolutions per min. The latter motor speed corresponds to 80 revolutions of the drive wheel p.m., and a speed of 8½ miles on the level. With the maximum load of 6,600 pounds the current consumption on the level is from 36 to 38 amperes, and the specific energy required per ton mile is, therefore, about 112 watt-hours.

The accumulator battery consists of 40 elements, and is placed in a case under the frame of the vehicle and between the two axles. The latter is solidly attached to the frame by means of hooks and windlasses and by six safety rods. The capacity of the battery is 200 ampere hours at a 5-hour discharge, and its total weight is between 1,550 and 1,650 pounds. A single charge is sufficient for a run of 38 miles.

The controller shaft is concentric with the vertical steering rod, and the controller hand lever is seen just below the steering hand wheel. All the cells of the battery remain always in series, and the controller has 13 different positions: six speeds ahead, two starting positions, one reverse speed, two electric braking positions and two stops. The various groupings effected by the controller are indicated in the following table:

TABLE OF CONTROLLER CONNECTIONS.

| Position of controller. | Rôle. | Rhostat. | Battery. | Armatures. | Excitation. | | Shunt to Series Coil. |
|---|---|---|---|---|---|---|---|
| | | | | | Shunt. | Series. | |
| —2 | Reverse speed | short circuited | in series | in series reversed | shunted across battery | in circuit | out of circuit |
| —1 | Starting backward | in circuit | " | " | " | " | " |
| 0 | Stop | open circuit | open circuit | open circuit | " | open circuit | " |
| 000 | 2d brake | short circuited | " | in series | " | closed across the two armatures in an inverse sense | " |
| 00 | 1st brake | in circuit | " | " | " | | " |
| 0 | Stop | open circuit | " | open circuit | " | open circuit | " |
| 1 | Starting ahead | in circuit | in series | in series | " | in circuit | " |
| 2 | Slow speed | short circuited | " | " | " | " | " |
| 3 | Medium speed | " | " | " | " | " | in circuit |
| 4 | " | in circuit | " | in parallel | " | " | out of circuit |
| 5 | Normal speed | short circuited | " | " | " | " | " |
| 6 | High speed | " | " | " | " | " | in circuit |
| 7 | Recuperation | " | " | in series | " | short circuited | out of circuit |

Besides the electric brake and the recuperating action of the motor, two mechanical brakes have been provided. The first of these is a hand brake, acting on brake drums, fastened to the hubs of the drive wheels and concealed in the gearcase. It is operated by a double-foot lever, placed under the feet of the conductor, on each side of the controller. The lever to the left simply acts on the switch, breaking the current when it is desired to slow down, while the lever to the right first interrupts the current and then draws on the brake.

The other brake is a shoe brake on the rear wheels, operated by a hand lever to the right of the conductor.

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The Montreal Automobile Co. is applying for a charter in Canada. The capital is $250,000.

## THE BRADLEY GASOLINE CARRIAGE.

The accompanying illustrations represent the completed automobile and the running machinery of a motor wagon constructed on the plans and drawings of Hiram T. Bradley, of Oakland, California, a mechanical engineer, well and favorably known on the Pacific Coast. The style represented is designed for heavy work over ordinary country roads; it is well adapted for a physician or any one who needs a conveyance always ready for service. It has a seating capacity for two persons.

The total weight of the carriage, including sufficient water and gasoline for an 80-mile run over an ordinary road, is 960 pounds. It has wire wheels with three-inch pneumatic tires. The running gear is constructed of steel tubing, and the frame which carries the engine and the variable speed device is made of angle iron, which secures the greatest strength with the least weight of material.

The arrangement of the engine with its necessary working parts can be readily seen from the illustration. It is compact, but at the same time the essential parts are so arranged that they are easily accessible.

The body is so placed on the frame that it can be taken off in 15 minutes should it be necessary to do so, in order to get at any part of the working machinery.

A controlling lever worked by the left hand acts on an improved vaporizer by means of which the speed of the engine is regulated. A foot pedal operated with a lock joint throws into movement the three positive speeds and the reverse.

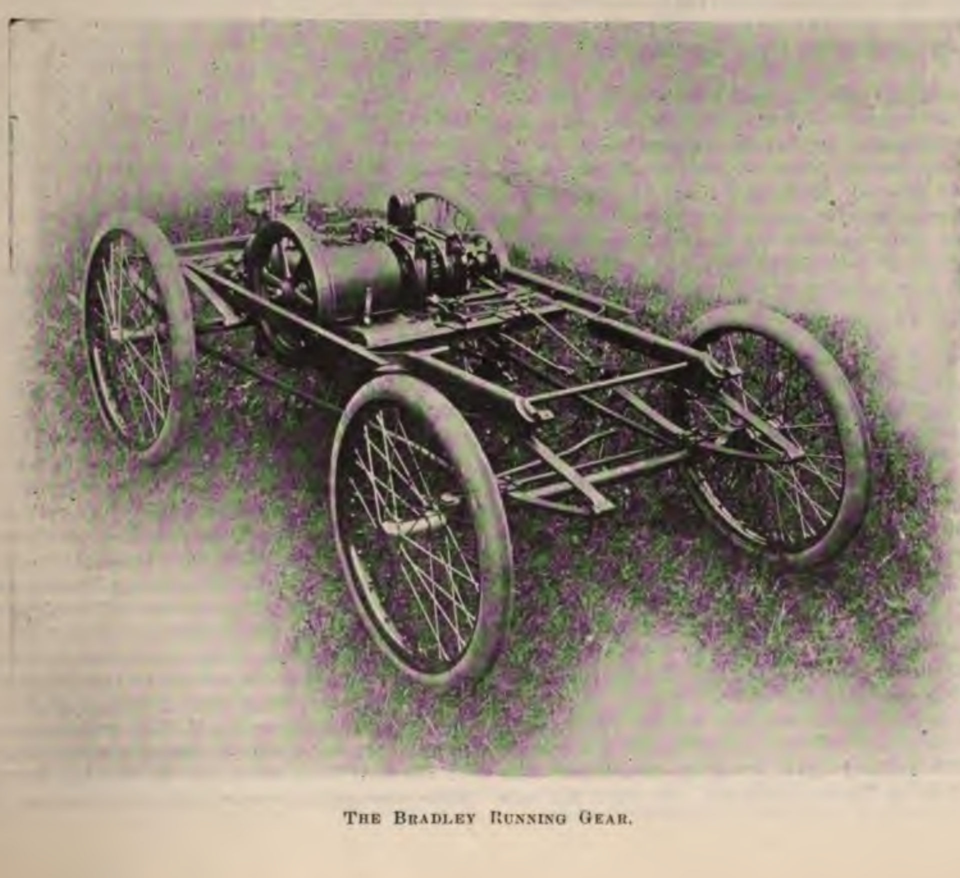
The motor develops about five and a half horse power. It is of the four-cycle type, with twin cylinders, the cranks being set at 180°.

The transmission of power is direct from the motor shaft through the variable speed device to the rear axle by means of chain and sprocket. The compensating gear is mounted on the rear axle in an enclosed case, thus keeping it free from dust. The driving mechanism is geared into the compensating gear mounted in the same case, thus allowing it to be swung over the centre of the axle, whereby an adjustment for length of chain is secured. Cooling coils are placed under the foot board, thus making it unnecessary to refill the water tanks frequently.

While in many particulars the Bradley automobile is necessarily quite similar to others using the gasoline engine as a motive power, still there are parts secured by patents which render it superior. Among these may be mentioned the variable speed device, which is novel, simple and effective, doing the work for which it is designed in a satisfactory manner. The vaporizer is an exceedingly ingenious piece of apparatus, which automatically secures just the needed supply of gasoline.

We understand that the Pacific Motor Co., of Oakland, Cal., is making arrangements to build these carriages.

THE BRADLEY GASOLINE CARRIAGE.



THE BRADLEY RUNNING GEAR.

## ...OUR... FOREIGN EXCHANGES

### BATTERIES FOR ELECTRIC VEHICLES.

Dr. Sieg, discussing the subject of portable batteries in No. 10 of the *Centralblatt für Accumulatoren und Elementenkunde*, says that there is still considerable divergence of opinion concerning their usefulness, and that the breakdowns which have occurred on the Berlin tram lines have given a fresh handle to those who oppose their employment. He does not concern himself with these breakdowns or with their causes, but passes on at once to the general consideration of the employment of batteries for the propulsion or ordinary road vehicles. In stationary batteries it is only the chemical processes involved in the storage of the current which act injuriously on the plates, and as there is no necessity to keep down the weight or size of the batteries, heavy electrodes may be employed, spaced far apart, and a good depth may be left below the bottom of the plates, so as to reduce the risk of damage from short circuits and buckling to a minimum. The work required of the battery is also known accurately beforehand, so that damage due to overstrain can be avoided. But in the case of batteries propelling automobiles the conditions are very different. Weight and size have to be restricted as much as possible, in order that the vehicle may not be too heavy, for weight not only increases the working cost of the vehicle, but also reduces its handiness. The amount of current used, and therefore the demand on the battery, varies with the conditions of working and the state of the roads. Wet roads, sandy soil, stones, etc., increases the demand enormously, so that not only the normal current, but also the normal capacity, may be far exceeded. The batteries are also constantly subjected to severe jolting, which seriously affects their life. Dr. Sieg then proceeds to the consideration of the properties which are required in an automobile battery, and, as a preliminary, lays down certain requirements which must be fulfilled.

The weight of the empty carriage ought to be from one-half to three-fourths of the weight to be carried by it, according to the method of construction employed and the speed to be attained. For the conveyance of passengers, two-thirds of the total weight may be allowed. This total weight is made up as follows: The motors, which for a passenger car for a speed of 15km. to 18km. per hour amount to one-tenth of the total weight of the occupied car (W), the battery, (B), and the passenger weight which may be taken at 0.3 tons (four persons at 75 kg. each). It follows from this that

$$W=0\cdot6+2B.$$

As carriages exceeding two tons in total weight cannot be safely steered at a higher speed than 15km. to 18km. per hour, it follows that the battery weight must not exceed 700 kg.

Taking the commercial efficiency of the motor as 70 per cent., and assuming a traction co-efficient of 25, which is rather too low than too high on a good road, the consumption of energy by the carriage in 18 kilometre-hours, or 5 metre-seconds, works out to $1{,}750\times W$ watts. Assuming that the carriage will require to run at least three hours on one charge, that is somewhat over 50km., which corresponds to the daily service of a taxameter cab, the battery will require a capacity of 5,200 watt-hours; *i. e.*, in order that the working generally may be possible, the battery must yield at least 10·5 watt-hours per kilogramme weight, or be capable of yielding 5·5 ampere-hours at a 3-hour discharge at a potential of 1·9 volts.

As it will seldom happen that a carriage will be called on to give its whole yield without some stoppage, it will, as a rule, be sufficient when the battery gives 8 ampere-hours per kilogramme with a 5-hour to 6-hour discharge. Or when the battery has a higher capacity per kilogramme weight, a smaller battery weight than 700 kg. will suffice; but if the battery has a lower capacity, it will not maintain the daily work of 50km.

For stationary batteries the capacity per kilogramme varies between 3 ampere-hours to 5 ampere-hours, so it is evident that to fulfil the conditions required by an automobile the battery must have only about half the weight of a stationary battery, or else have double the ordinary capacity. Weight may be reduced by making the cells themselves lighter, which can be done by employing vulcanite in their construction instead of glass, etc. The weight of the acid may also be diminished by reducing the distance between the plates, and the space allotted to them, but since the production of an ampere-hour always requires the consumption of a definite quantity of pure sulphuric acid, the diminution of the quantity of the electrolyte must be compensated for by an increase in its density, which at once has the injurious effect of raising the working potential of the cell. The reduction of the distance between the plates is further attended with the risk of short circuit from a very small amount of buckling, which is best obviated by the employment of perforated and corrugated distance plates of vulcanite, such as those manufactured by the Hagen Accumulator Works at Cologne. This construction is also employed by other leading manufacturers of automobile cells, such as the Société Fulmen of Paris, who adopted it after making trial of other methods. They found that flat separators, spaced by rods of insulating material, gave unsatisfactory results, because the circulation of the electrolyte was interfered with, as also was the descent to the bottom of the cell of the material dislodged from the surface of the plates. All gelatinous electrolytes have been failures, and all attempts to absorb the fluid electrolyte by dry fillings have had a similar fate, since a rapid circulation of the electrolyte through them is impossible. With a quick discharge they have a very high internal resistance, and they lower the capacity of the cell, while the gas bubbles soon form little hollow spaces and channels in the material, in which the active material dislodged from the plates collects, and this occasions short circuits. The cost of these corrugated vulcanite separators is certainly very high, and therefore any cheaper method for satisfactorily attaining the same end would be welcomed.

But a decrease in the weight of the acid and of the boxes is not sufficient alone to raise the specific yield of automobile cells to about double that which is obtained from stationary cells, for the weight of the electrodes in the latter is about 50 per cent. to 60 per cent. of that of the total weight of the cell. Thus a considerable reduction is also required in the weight of the cells themselves, which can only be effected at the expense of their durability. The same durability, therefore, must not be expected from automobile cells as is required from those which are stationary, especially as the diminution in weight entails thinner plates, from which more chemical activity is expected and greater current-carrying capacity, while mechanically they are subjected to the strains involved by perpetual jolting.

Of the three types of accumulator at present in use, *i.e.*, the large surface plates, the grid plates, and the block, the second is alone suitable for automobile batteries, because with the first-named the requisite yield of 8 ampere-hours per kilogramme cannot be obtained, and in the block plates the distribution of the current is not uniform, so that whole blocks lose contact with the supporting frames and drop out. The requisite specific yield, combined with a reasonable durability can be obtained from the grid type if care is taken in the filling in of the plates that there is no break in the continuity, either of the lead salt, or between it and the supporting grid. Either a light double grid, riveted together, such as is employed in the Fulmen cells, or an E. P. S. grid, or any other of similar type, give good results if due care is bestowed on the filling in of the active material, and in placing the separators so that their corrugations press against the plates. As the result of

experiments which have extended over two years at the Cologne works, Dr. Sieg has arrived at a method of construction which gives good results. For both positive and negative plates, hardened lead grids are employed having a thickness of 3mm., and whose mesh is 15mm. square. The plates are 130mm. wide, 200mm. high, and are mounted about 3mm. apart. The negatives stand on the bottom of the cell on legs 25mm. high, while the positives are suspended above them from vulcanite rods, so that they have room for downward expansion. By the employment of a specially prepared paste, Dr. Sieg succeeded in fixing it securely in the grid, and in obtaining a yield of 10 amperes per kilogramme, with a 5-hour discharge. Between the plates are placed hard-rubber separators half a millimetre thick, and the plates of like sign are united to each other by burning.

The first of these batteries was delivered to the Cologne Elektricitätsgesellschaft in March, 1899, and since that time has propelled a vehicle which has been used partly for business purposes and partly for the personal needs of the directors. The carriage weighs about 1,200 kg., and has an 80km.-hour range. At the end of April, 1900, the cells, which had hitherto required no repairs, were cleaned, and it was found that the negative plates were still faultless, whilst the positive plates, although they had lost some material, were apparently capable of carrying on the work for some time longer. Before the battery was cleaned, the carriage had travelled with one charge over 60km. over somewhat soft roads, and the battery had still its initial capacity of about 120 ampere-hours, with a 5-hour discharge rate. These favorable results determined the Cologne Elektricitätsgesellschaft to give the Hagen works a commission for 19 batteries for employment on the cab service they were about to start in Cologne and Düsseldorf, and some of them have lately come into use.

Since the Spring of 1899 experiments have also been conducted in the carriage building works of Heinrich Scheele in Cologne. He tried types of conveyance ranging from the lightest high-speed vehicle to a heavy goods' wagon capable of carrying 5 tons, and hitherto the batteries have given no cause for complaint. In the laboratories the batteries had yielded about 300 discharges at a 2-hour rate before a change of plates was necessary, and one may, therefore, reckon on at least 150 discharges being obtained without any repair being required when the batteries are employed for automobile traffic. Since those portions of the cell, whose first cost is highest, *i. e.*, the vulcanite cases and the separators, suffer but little deterioration in use, it is quite sufficient to allow 30 per cent. of the initial cost of the batteries for their maintenance, and on these terms the makers are willing to undertake the maintenance of batteries in any towns in which they have agents.

Still more information concerning the durability of the batteries, and their behavior under all conditions of work, should be gained as the result of the experiments being carried out in Berlin by the "Automobilkonkurrenz."

One circumstance may be mentioned which is of special interest to manufacturers, and that is that out of 40 batteries which the Hagen Company have already delivered, three did not maintain, when in work, the capacity which they had before being sent out from the factory, and on examination it was found that there was loss of contact between the active material and the grid in the negative plates, occasioned by their having been exposed to frost before formation, and with this exception, the faulty plates differed in no respect in weight or construction from those which gave good results. Experimental batteries have been supplied to the tramway service in Bremerhaven, which weigh about 2,000 kg., and will run cars weighing 11 tons for an uninterrupted journey of about 140 kilometres. The batteries have been in work since December, 1899, and have gone without stoppage through the heaviest snow without a change of plates being necessary. It remains to be seen how long these batteries will retain their efficiency, but if they only require to be renewed once in six months a satisfactory return will be obtained from them.—*The Electrician.*

## THE WACHÉ AND KRIEGER EXPANSIBLE PULLEYS.

The ingenious system of expansible pulleys, which we illustrate below, is described by *La Locomotion Automobile.* Either pulley may be expanded to double the diameter of the other, thus giving a total speed range of one to four. As will be seen from the illustrations, the pulley surface is made up of steel lattice work of the lazy-tongs variety, such as is familiar in elastic napkin-rings and other articles. This lattice-work is mounted at six points on blocks which slide in radial slots in a disc or plate at one side of the pulley. Two ears, with a pin through them, project inward from the middle of each block, and this pin passes through a slot in a radial-curved spoke. These spokes are pivoted near the hub, and have teeth meshing with a toothed or grooved sleeve on the shaft. Movement of this sleeve along the shaft spreads or closes the spokes, and the latter by virtue of the curvature of their slots, expand or contract the lattice rim.

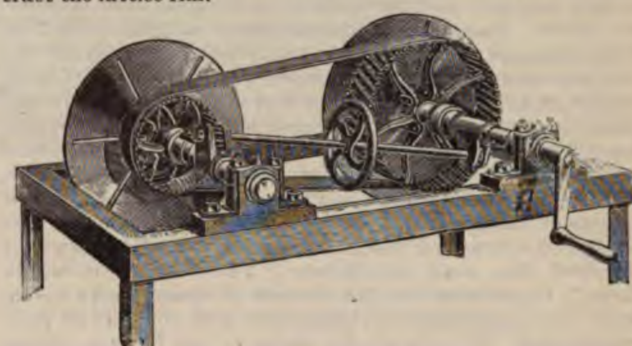


Fig. 1.

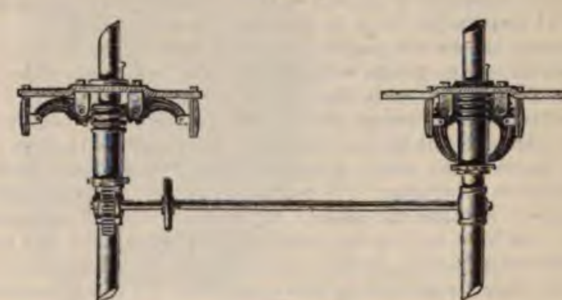


Fig. 2.

The pulleys are, of course, used in pairs, and the sleeves have other teeth or grooves on their outer ends, which are simultaneously acted on by pinions, one above and one below the sleeve, in such wise that as the sleeve of one pulley is shifted in that of the other is shifted out, and one pulley, therefore, contracts as the other expands. The pinions are mounted on a light shaft, which may be rotated by hand or by gear connection with a speed-changing lever.

## AUTOMOBILES IN WAR.

At the recent German military maneuvers four-wheeled automobiles containing an officer and driver were used, for the most part, for the speedy conveyance of the elderly staff officers, and some of them ran at a speed as great as 20 or 40 miles an hour. In the Franco-Prussian war a hard day's march of 24 hours for transport wagons was 50 miles. At the end of each march the horses were useless. In the recent maneuvers, motor wagons traveled at the rate of seven miles an hour, and a day's work, of 10 hours, was 70 miles. War authorities consider that the day is not far distant when train horses will be replaced to a considerable extent by petroleum motors.

## OPINIONS WISE AND OTHERWISE.

Our London contemporary, *The Engineer*, comments in part as follows on the discussion which followed the reading of Professor Hele-Shaw's paper on Road Locomotion, read before the Institution of Mechanical Engineers, and partly reprinted in our columns:

One result of lack of acquaintance with the conditions of road locomotion has been that much time has been wasted in learning lessons quite familiar to men of experience. A favorite theory was that self-propelled cars could be made which should weigh little more than an ordinary horse-drawn vehicle. If a horse could draw a victoria at a good pace, then an engine of one or at most two horse-power could do the same. Our readers will no doubt remember the vehicles shown at the Crystal Palace, in which this theory was carried into practice. It is, perhaps, enough to say that the light car is a thing of the past. A really satisfactory motor car to carry four persons weighs at least one ton; and the tendency is to make them heavier, not lighter. Instead of two-horse-power sufficing, from 7 to 30-horse-power is provided, the latter being essential for the very high speeds favored by those who have done their best in France, at all events, to make the motor car an intolerable and dangerous nuisance. It is, of course, true that a few light cars are still in use. They potter about very well on smooth, level roads, but for general utility purposes they are impracticable. The traction engine makers had found out years ago that light engines of three or four tons were of very little service. The hauling of a thrashing machine from farm to farm was about the most they could accomplish. "There was no money in them." In the same way the pioneers of steam tramways insisted that a locomotive weighing four tons could do all that was wanted. We were severely taken to task for maintaining that not less than nine tons would do, and to-day we doubt if there is a successful tramway engine running that weighs less than 11 tons, while 13 or 14 tons is a normal weight.

Leaving on one side passenger motor cars, let us see what is known about the goods, wagons and vans, which are either to supplement or supersede the railways. As we listened to Professor Hele-Shaw's paper, and to the speakers who took part in the discussion, it became more and more evident that on the vital factor in the whole question there was no trustworthy information available. The passenger motor car is an article at present, and for the present, of luxury. A good one costs £400. We have not yet met with any individual who has been satisfied with one car. Most of those who use them have had two or three cars, or are having new cars built. All this is excellent for trade. But the goods' vehicle is on quite a different footing. Unless it can be shown that the new mode of locomotion is at least as cheap as horse traction, it has no chance of permanent success. A firm may start in business as builders of steam goods, vans. Unless the public find by experience that it is cheaper to use a steam than a horse vehicle, the firm will fail. With the passenger carriage the position is quite different. No man expects to make a private carriage pay. A company establishing a service of road wagons or lorries is on quite another footing.

We have not the smallest hesitation in saying that no one really knows what it will cost per ton to haul goods by steam or gasoline vehicles between any two large towns—say Liverpool and Manchester—for a year. It is not difficult to say what the first cost of the plant will amount to; nor is it, perhaps, hard to say what the cost of the fuel, water, and the driver will be. But beyond this all is conjecture. To assert, for example, that 15 per cent. per annum is enough to allow for depreciation, or that a sovereign a day will cover the cost of repairs, is simply talk. No one knows; and even if some one individual had had sufficient experience to be able to speak with certainty of one district, that experience would not necessarily apply in another. The great difficulty in dealing with the question lies in the enormous diversity existing in the conditions under which the traffic is to be carried on. Nothing approaching to this diversity is met with in railway practice. The difference between a good and a bad railroad is as nothing to the difference between a good and a bad common road. A motor van which may be run giving contentment and even pleasure in dry weather, may become a burden to the flesh and an occasion for bad language when rain has fallen for a few hours, and may be useless in winter. Only those who have had experience in working traction engines in all weathers can realize what country roads are like when a frost has broken up or there has been an abundance of rain. The result of all this is that no one can tell how much to allow for depreciation, how much for maintenance. Wheels seem up to the present to have falsified every prediction. No one seems as yet to have produced a satisfactory wheel. Steel is, after much heart-burning, being given up. It ought never to have been used. A modification of the Mansel railway wheel, made either of wood or compressed paper, is the best non-elastic wheel that can be employed. India rubber will be found far too costly for goods, wagons. If steel is to be used, then it must be in the shape of stamped plate wheels. It has at last come to be understood that the maintenance of driving wheels must represent a very heavy item in the cost of traffic. Nothing was said at the Institution of Mechanical Engineers to induce the belief that the wheel problem has been solved. It is a bad sign that the motor-car man shouts for the improvement of the roads. It is as though he was driven to admit that he could not devise a vehicle which works satisfactorily on roads as they are.

A good deal of energy is being expended now in devising engines, and boilers, and condensers, and silencers, and so on, yet these are quite secondary things. Whether a self-propelled road wagon traffic can or cannot be made to pay will depend in the long run on the performance of the wagon, not as an engine, but as a vehicle. This is the crucial point. The first essential is the scheming of a carriage that cannot be shaken to pieces. The difficulty of doing this is very great. Thus, for example, it will not always do to make a bar strong to keep it from breaking. Its own weight and stiffness may bring about fracture. Long flexible springs will pay for their use; but no doubt a few persons have found out these things for themselves already.

## THE DANVIN DUST COLLECTOR.

*La Locomotion Automobile* shows a novel form of centrifugal dust separator, or *cyclone*, as the French call it, which it describes as follows:

The dust-laden air enters by the tangential orifice A; the dust collects in B, and the unified air escapes by way of the inner tube-section C. The high efficiency of the collector, in view of its very small volume, is due precisely to the spiral form of the separator and to the helicoidal line followed by the lower edge of its walls.

In the usual forms of centrifugal separators, a double effect is produced: (1) The centrifugal force tends to project solid particles against the outer walls, where they are dropped. (2) The friction of the solid particles against the walls is greater than the friction of the air in which they are carried, and they are, therefore, retarded more.

It is the result of this double action which effects the separation of the solid particles in the air. Evidently the centrifugal force will be increased if the velocity of the stream of air remains a constant, in proportion as the radius of the spiral is reduced; and moreover the surface exposed to the fricton of the dust particles is greatly lengthened, within the space filled by the collector, by the spiral form shown. Practical tests are said to have demonstrated the efficiency of the apparatus.

Our contemporary remarks that it may be questioned if the use of such a separator would not result in material diminution of the volume of air reaching the motor, but this could be settled only by actual trial.

## THE AWARDING OF PRIZES FOR THE 1000-MILE TRIAL.

The following are the leading headings under which marks were allowed by the judges' committee in recommending awards after the 1000-mile trial of motor vehicles in England:

Price.
Weight.
H.P. shown by performance.
Persons carried.
Price in proportion to seating capacity occupied.
Price in proportion to power of motor.
Power in proportion to seats occupied.
Power in proportion to weight.
Mechanical efficiency, as shown by Hill-climbing Trial.
Simplicity of transmission.
Accessibility of mechanism.
Quality and sufficiency of speed gear.
Easiness of adjustment.
Steering gear.
Brakes and brake gear.
Ignition arrangements and apparatus.
General design, mechanically.
General design, appearance.
Average speed on trial out of control in proportion to average of legal limit.
Workmanship, especially of machinery.
Condition of car at end of trial.
Regularity of running on trial.
Breakages and defects not previously mentioned.
General observance of Trial Regulations.

While not entering into detailed criticism of the performance, structure, and condition of the vehicles before and after the trial, as all these questions were separately considered with respect to every car, and numerical value given to each in making the awards under the above headings, yet the judges drew attention in their report to the extremely satisfactory progress which has been, and is being, made in the construction not only of the carriages generally, but in the arrangement, accessibility and workmanship, particularly in England, of the transmission and other gear of many of them. Marked improvement was noted also in the carriage builders' work of several automobiles, the carriage builders having realized the possibility of, and necessity for, lightness of construction, combined with comfort and elegance. Aluminum has been used successfully in making these bodies, and the same metal has been largely employed in the fixed parts of the machinery.

The reduction in weight which has been thus effected by some British manufacturers the judges considered to have had a marked effect upon the hill-climbing powers and efficiency of the vehicles as a whole.

The judges' committee noted particularly that most of the failures of vehicles to obtain good records on various stages were due, not to the failure of motor or of the transmission gear, but to structural weaknesses in other parts of the carriage. For example, breakage of axles took place in three instances, and the puncture of pneumatic tires was especially responsible for delays. It is well, then, that the general public, when forming an impression of the trial, should bear in mind that a large proportion of the delays cannot properly be put down to what are usually known as "breakdowns" of the motor.

Special prizes were offered for public-service vehicles, it being evident that the transmission gear used in the ordinary light, privately-owned carriage is not suitable for use in vehicles constructed to carry large numbers of passengers.

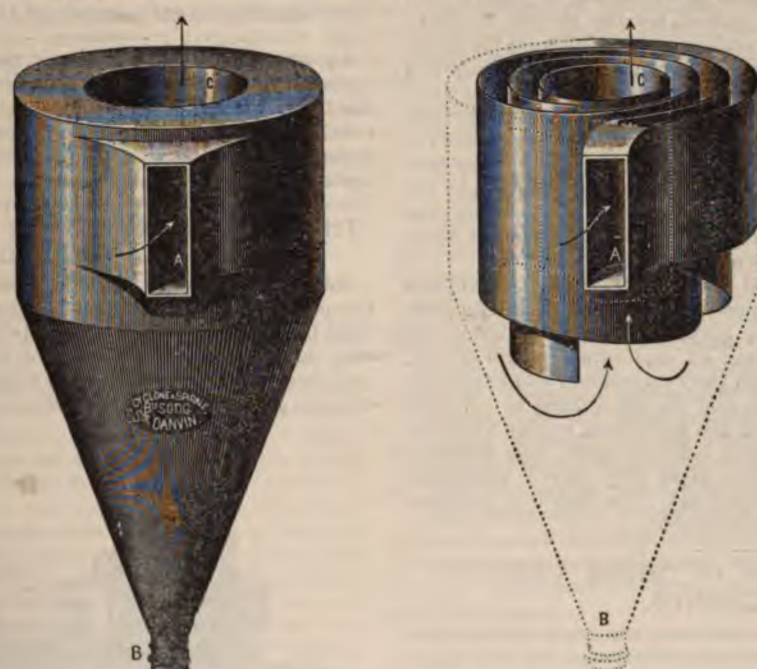
Among the numerous prizes, the following awards were made in classes A, B and C of Section I (vehicles entered by manufacturer or agent):

Class A (vehicles declared at a selling price of £200 or less)—1st prize, Benz Ideal; 2d prize, Locomobile Steam car, New Orleans Voiturette.

Class B (vehicles declared at a selling price of more than £200, but not more than £300)—1st prize, Wolseley Voiturette; 2d, prize, Motor Car Co.'s Triumph; 3d prize, De Dion Voiturette.

Class C (vehicles declared at a selling price of more than £300, but not more than £500)—1st prize, Divided between three Daimler Co.'s Cars; 2d prize, Divided between two Motor Manufacturing Co.'s Cars.

The judges' committee was composed of the following well-known engineers and motorists: Archibald Barr, Hudson Beare, W. Worby Beaumont, C. Vernon Boys, D. S. Capper, Bryand Donkin, H. S. Hele-Shaw, H. C. L. Holden, Wm. H. Preece, Boverton Redwood, David Salomons, Bart., James Swinburne, Wm C. Unwin, A. F. Yarrow, Dugald Clerk.



THE DANVIN DUST COLLECTOR.

Sir David Salomons signed and approved the report and awards' subject to dissent from placing the locomobile carriage for a prize, on the grounds that at the present time the locomobile does produce visible steam contrary to the 1896 Locomotives on Highways Act; also that the boiler interior is virtually inaccessible; consequently until these defects are remedied, the carriage should receive no mark of commendation whatever. This certainly seems like hypercriticism. The American light steam carriage may not be perfect (neither is the gasoline carriage), but it is not dangerous on account of its boiler.

## THE RAVEL "INTENSIVE" MOTOR.

In THE HORSELESS AGE of June 27 was published a synopsis of a recent American patent taken out by Henri Crouan, of Clichy, France, for an opposed cylinder, four-cycle engine in which the crank-case, being enclosed, acted as an air pump to draw in a double supply of air, delivering this alternately first to one and then to the other cylinder at the end of their respective exhaust strokes. In a recent issue, *La France Automobile* describes at lenght a similar motor invented by Joseph Ravel, and called by him the "Moteur Intensif." This motor, says our contemporary, is vertical, with twin cylinders and with both pistons working on one crank pin. It was first brought before the public at the exposition of automobiles in 1899, where it attracted much attention. The crank-case is enclosed, and air is drawn in by both pistons, on their simultaneous up-stroke, a double "stroke volume" being thus drawn into the crank-case. Since in a motor of this type the power impulse takes place alternately, first in one and then in the other cylinder or each down stroke, it follows that when the inlet or suction valve of one cylinder is opened, for the suction stroke to take place, both pistons will act to compress air from the crank case into that one cylinder, with the result that the pressure in the cylinder, at the end of the suction stroke, is somewhat above that of the atmosphere. The inventor makes the claim that the volume of air (or mixture) pumped into the cylinder is double what would be drawn in by the ordinary process of suction, but it is not clear how this can be the case, as the pressure in the cylinder cannot exceed that in the crank case during the transfer stroke, and there will, therefore, be some mixture left in the crank case and not transferred.

The combustion chamber of the cylinder is made of a volume equal to the stroke, and the pressure at the end of the compression stroke is said to be 2½ kilos. per sq. cm., or about 35 pounds per square inch, giving an explosion pressure of 170 pounds per square inch. Both the compression and explosion pressures are very moderate, and we are obliged to conclude that the benefit derived from the additional charge forced in takes the form of an expansion curve of more than ordinary fulness, due to the combustion being only partly completed when the piston begins to move out. The very low compression makes this hypothesis reasonable.

## THE FRENCH LAW IN MOTOR VEHICLE ACCIDENTS.

A legal contributor, Albert Rodanet, expounds in the pages of *La Locomotion Automobile* the provision of the French law in the case of accidents to motor vehicles, whereby employes driving the same come to bodily hurt.

Our readers are aware, says M. Rodanet, that a law was passed, on April 9, 1898, which increased considerably the pecuniary liability of those employing servants. The old legislation of arts, 1382 and 1384 of the Civil Code, which fixed the responsibility of an accident on the individual by whose fault it occurred, has been replaced by the new law, which relieves the employe of the need of proving that the blame lay with the company employing him, and which fixes the indemnity to be paid to the victim or to his heirs. The pecuniary responsibility of the employer is heavier than before. He is required, in the case of permanent and partial disability, to pay to the injured employe a pension equal to half the reduction in the latter's wages. In case of permanent and complete disability, the pension must be equal to two-thirds the man's wages at the time of the accident. In case of death, the pension is to be paid to the wife and minor children of the deceased.

As the law of 1898 is a "law of exception," which applies only to commercial or industrial enterprises which make use of machines "propelled by a power other than that of man or animal," all those employing help on vehicles other than of this description benefit by the old provision of the Civil Code. The builders of gasoline and electric vehicles, etc., fall manifestly under the provisions of the new law.

But how is it with the plain *chauffeurs* who employ a *mécanicien* to attend their vehicles? are they too bound in case of accident to pay the heavy compensations of the law of 1898?

The consulting committee of accident insurance, which has received a communication from the Minister of Commerce regarding the interpretation of the law, takes the negative view. It has rendered an opinion to the effect that the law covers only vehicles employed in some transportation enterprise or in an industrial, commercial or agricultural work.

In other words, the owner of a pleasure vehicle is not subject to the provisions of the law of 1898; and the same applies also to navigation for pleasure.

The wording of the law itself indicates this, and by implication exempts the non-commercial individual. The *chauffeur* is not liable, therefore, unless his employe shows that the accident occurred by his fault.

A motor-car service between the tramway terminus at Woodside and Bucksburn, N. B., has been instituted by the Northern Cycle Manufacturing Company, of Aberdeen.

*La France Automobile* states that experiments are being made under the direction of M. Vignat, director of the Société des Huiles Minérales of Colombes, with a new liquid fuel, which it is hoped may some day take the place of gasoline. This fuel is derived from coal, and is said to have been tested in different motors with good results.

## THE B. G. S. RECORD-BREAKING ELECTRIC VEHICLE.

We are indebted to the *Automotor Journal* for the accompanying illustration, which shows the electric machine built by Bouquet, Garcin, and Schivre, and which achieved last May the wonderful performance of 164 miles on one charge, at an average speed of 10 miles per hour. Particulars of the vehicle were given on p. 22 of our June 6th issue.

## A COMING RECORD-SMASHER.

*La France Automobile* assures its readers that it has had the privilege of inspecting a nearly-completed *voiture de course* of no less than 100 horse power, which is being built for Lemaitre, the celebrated French *chauffeur.*

It is a Peugeot, says our contemporary, and is driven by a vertical motor of eight cylinders, coupled and disposed two and two at the front end of the vehicle. An enormous combined flywheel and clutch is driven by the eight cylinders, and engages a train of gears arranged with longitudinal axis. The wheels have tires of 15 cm. (six inches) section. The body is aluminum, of skeleton design, and should weigh from eight to ten kilos. Seventy-five miles an hour is the speed looked for from this machine. Brrrr!

## AUTOMOBILE COMPETITIONS.

There has recently been concluded in Berlin a competition, instituted by the Mitteleuropaischen Motorwagen Verein, between various types of electromobile cars. On the first day the weights, dimensions and other particulars of the competing cars were ascertained, and subsequently the batteries of the cars were discharged to the minimum potential permitted, this being about 1.83 volts per cell, and then recharged, in order to determine their respective capacities. They were then left in a charged condition until the following day, in order to ascertain if any deterioration had occurred. On the second day, after an inspection of the cars, a trial run, at an average speed of 9½ miles per hour, was entered upon, in order to ascertain the conf sumption of energy. After about three-quarters of the predetermined capacity of each car battery had been discharged, the return journey was made to the starting point, where the remaining charge in the batteries was discharged through resistances, the potential of the cells being observed during the operation. The batteries were then recharged again. The tests were conducted with considerable care, and although the trials were of too short a duration to indicate the ultimate endurance of the competing accumulators, some interesting results were obtained as to the carrying capacity and range of the electromobiles.

## A LONG AUTOMOBILE TRIP IN AUSTRALIA.

The Thomson steam carriage completed a successful and eventful journey of 500 miles at midday on Wednesday, the 9th ult., when it arrived in Melbourne from Bathurst, New South Wales, with Herbert Thomson, the inventor, and E. L. Holmes, who essayed the task of putting up a record in something new to Australia, viz., a long-distance trip on a motor carriage. The start from Bathurst was delayed a couple of days, owing to heavy rains, and the effects of the rain made the traveling very heavy for a while. In one place, a bridge having been washed away, the car had to be driven across a ford, and was got through the mud with difficulty. Notwithstanding the hilly nature of a considerable portion of the route, fair progress was made throughout. The accidents were, states the *Melbourne Age*, very slight, consisting only in the breakage of a couple of small struts, which were easily replaced. Messrs. Thomson and Holmes are the first to accomplish a long motor-car journey in Australasia without the assistance of horses on any part of the way.

## MOTOR DUST CARTS WANTED.

The Public Health Department of the City of London wanted an electrically-driven dust cart, and the Public Health Department is now suffering from disappointment. A contemporary "learns"—we like that word—"that although advertisements were inserted in all the journals likely to secure offers for these vehicles," no inquiry was received, and the electrical engineer to the City Corporation has come to the sage conclusion that "none of the people likely to take up such a matter have considered what excellent conditions a dust cart service offers for the use of electricity." Firstly, advertisements were not inserted in all the journals likely to bring forth replies, for our advertisement manager mentions the name of a paper familiar to our readers, as well as ourselves, in which no such advertisement appeared. Thus it will be seen that neither the resources of civilization, nor the means of publicity have been exhausted. Unsuccessful in their quest for an electrically-propelled dust cart, why will not the Public Health Department be content with a steam vehicle? These are now being operated with conspicuous success, and would prove economical in the City of London, where rapidity of street cleaning is an essential factor in the removal of refuse.—*The Motor-Car Journal.*

## SPEED OF MOTOR TRICYCLES.

A correspondent of the *London Daily Express* writes: There is a growing tendency to fit motor-tricycles with engines that are far too powerful for English roads. The rider of a 3-h. p. Rochet tells me that last week he towed two cyclists to the top of the Hindhead, with their feet on the rests all the way. An engine that will do this is obviously overpowered for ordinary purposes, and may produce an accident at a sharp corner. It takes some little time, indeed, to acquire the power of guaging the turning capacities of the three-wheeler even with a 1¾ or 2¼-h. p. engine. Last Summer a rider came to grief at the corner of the slope leading to Frensham Great Pond. He rolled over the bank, and was rather badly hurt.

A few days ago a gentleman accustomed to a quadricycle borrowed a three-wheeler. He had only about six miles to go, and got along very well until he reached the corner of the road leading to his home. Here, however, he miscalculated the speed, and could not take the bend. The "trike" ran up a bank, and he jumped clear, without injury to himself, but the machine was completely ruined, and he had to buy the owner a new one.

## MOTOR WAGONS WANTED IN CUBA.

A New York export house has lately received a letter from a correspondent in Cuba saying that there is a demand there for automobiles suitable for transporting cane on the plantations and to the grinding factories. At present the work is done with bull-carts, and is unsatisfactory, owing to the slowness of this method, and because the animals are scarce and the price for them is advancing beyond all reason in the estimation of the planters. The larger plantations are equipped with railroads connected with the large grinding stations, but the smaller properties generally are less advantageously situated. It is from these that the demand for automobiles, it is thought, will be large if a suitable type can be constructed.

The correspondent wrote that a planter of experience told him such a cart should be an ordinary platform affair, without side and about seven feet broad, the capacity about three tons of cane. The wheels should not be high, and the motive power should be steam.

Extraordinary speed, of course, would not be a necessity, though ability to get over the ground with fair rapidity would be an advantage, since the wagons in that event could be transformed into passenger carriages between crop seasons. The roads on the estates, he says, are fairly good, and flat, iron wheels would obviate many difficulties.

The need is for a strong machine, even at the expense of appearances. The suggestions contained in the letter were communicated to several automobile factories, and were thought to be feasible.

The factories, however, are so rushed with the manufacture of cabs, runabouts and other pleasure vehicles that they are unable at this time to give the Cuban request practical attention.

It is said that such a vehicle would probably find a ready market in other sugar-producing countries.

# MINOR MENTION

Rochester, N. Y., is considering a speed ordinance.

It is announced that the Waltham Mfg. Co. is to manufacture motor bicycles.

The Asbury Park Council has voted to disbar motor vehicles which are noisy in running.

The Northwestern Motor Vehicle Co., of Minneapolis, has been incorporated with a capital of $100,000.

Ex-Queen Lil has ordered a steam carriage of the Baldwin Automobile Manufacturing Co., of Connellsville, Pa.

The starting and stopping handicap at the Ranelagh automobile gymkhana, July 14, was won by a locomobile, with E. Campbell Muir driving.

The New England Auto-King Vehicle Co., of Portland, Me., has been incorporated for the purpose of manufacturing motor vehicles. Capital, $1,200,000.

It is rumored that the Locomobile Co. of America may remove its Bridgeport shops elsewhere on account of the anti-speed agitation in that city.

Up to the date of going to press, we have not received the final program of the Chicago Automobile Exhibition and Race Meet. It will be published as soon as obtained.

As the result of a recent prize competition in its columns, the Philadelphia *Times* has given a "mobile" steam carriage to Letter Carrier R. B. McCandless, of Philadelphia.

The Carley Iron Works, of Colfax, Wash., are experimenting with a light gasoline vehicle of their own construction. It is reported to weigh 550 pounds and to have a 2½-h. p. motor.

Proposals to establish public services of motor cars between Oran and Nemonis, and between Oran and Bel-Abbes, Algeria, are at present receiving the consideration of the Oran Chamber of Commerce.

F. W. Barhoff, of Hartford, Conn., has invented a new storage battery in which the grids are made from lead wire. Important results in the way of weight reduction are claimed for this invention, and an electric carriage has been built to test it.

Statistics show that in the last month 661 accidents were caused by "animal traction" in France. These resulted in 59 deaths. Automobiles caused 39 accidents, two resulting in death. Bicycles caused 83 accidents, three resulting in death.

The Stanley Automobile Company of New York City has been incorporated with a capital of $5,000, to acquire automobile patents. The directors are Amzi L. Barber, S. T. Davis, Jr., Frederick DeP. Foster of New York City and David S. Walker and John Brisben Walker of Tarrytown.

The Committee on Chemical Hazards of the New England Insurance exchange has adopted a permit for the storage of automobiles using gasoline for power. This permit will be submitted to the exchange for action at its midsummer meeting, to be held August 4. If adopted, this permit will require a small additional insurance charge.

The Midland Motor Agency, of Acocks Green, Birmingham, has bought up the cars and stock of the Motor Touring Company, Ltd., of Llandudno and Stetchford, and proposes to run the cars to places of interest in the Midlands, and also to let them out on hire. The purchase includes the whole of the assets of the projected Motor Excursions, Limited.

By an amendment to its charter, the name of the Slaymaker-Barry Co., of Connellsville, Pa., has been changed to the Baldwin Automobile Manufacturing Co. The company was originally incorporated to manufacture hardware specialties, but it will now devote its attention to steam vehicles, on which it controls some important improvements.

The New York Motor Vehicle Co., is to locate its factory in Middletown, Conn., occupying the building of the Worcester Cycle Co. The company is capitalized at $500,000. In consideration of the remission of taxes on the plant, the company has guaranteed that its pay roll will be not less than $3,000 per week. The office of the company is at 26 Broadway, New York. Its officials are as follows: P. H. Flynn, president; Frederick C. Cocheu, vice-president; P. Sherwood Dunn, secretary and treasurer; Thomas F. Flynn, general manager.

Cadets from the Northwestern Military University started July 19th from Highland Park on a trip to Washington with the automobile rapid-fire gun, whose mount was built for the academy by the Duryea Co., about a year ago. The party will go by way of Toledo, Cleveland, Buffalo and New York. The best possible steady running time will be kept up without bursts of speed. The party will camp out at night along the route, and will secure additional supplies of provisions in towns on the way. Cooking and all work will be done by the boys under direction of the instructor. The nominal object of the trip is to carry a message from General Joe Wheeler to General Miles. Major A. P. Davidson goes in command of the party.

## LOCOMOBILE SHOP BURNED.

Fire in the drop forging shop of the Locomobile Company of America, manufacturers of the Stanley automobile carriage, did damage amounting to $25,000 on July 18th. The shop was gutted. The building was next to the large factory of the Locomobile Company, where the assembling is done, but this building was saved from damage. It is said that the fire will hang up the work in the shops of the company in Bridgeport and other cities, as the forgings were all supplied from Worcester.

## A STEAM NEWSPAPER DELIVERY WAGON.

The Providence *Journal* is making a trial of a steam vehicle built by the New England Motor Vehicle Co., of Waltham, Mass. It is of a light-wagon design, with canopy top and open sides. A sort of fence of wire netting is stretched around the stanchions, to retain the bundles of papers. The frame is flexible, and the wheels are 30 inches in diameter, with wire spokes. The boiler is 15x15 inches, tested to 600 pounds, and the engine is of the usual type, with two double-acting cylinders, 2½x3 inches. The vehicle weighs 800 pounds, and will carry a load of 500 pounds besides the operator.

## A NEW NON-SLIPPING TIRE.

A recent test of a non-slipping tire, invented by a Naugatuck man, Dr. K. Arvid Enlind, was made at Bridgeport by the Locomobile Co. of America, in which the efficacy of this tire was demonstr ted in a striking manner. An inclined plane, about 35 degrees in slope and 25 feet long, was covered with cakes of ice. A locomobile, its rear wheels shod with non-slipping tires, and carrying two men, was driven under its own steam to the top of the slope, where it was held by the brake while photographs were taken.

The new tire carries small steel spurs, not large enough to interfere with the use of the tire in the ordinary snow, etc., of winter streets, but yet sufficient to pierce the ice and be held.

# MOTOR VEHICLE PATENTS ∴ ∴ OF THE WORLD ∴ ∴

## UNITED STATES PATENTS.

652,942—Motor Vehicle.—Geo. E. Whitney, of Boston, Mass., assignor to the Whitney Motor Wagon Co., of same place, July 3, 1900. Application filed June 9, 1899.

The leading feature of this invention is the method of transmitting power from the motor to the axle. As seen in Fig. 1, the motor crossheads and connecting rods act on bell-crank levers $M^2$ $M^2$, from which other connecting rods $M^{12}$ extend to cranks $c^1c^2$ on the rear axle. The latter is divided, and has a differential C adjacent to the crank $c^2$. The crank $c^1$ is loose on the adjacent half of the axle, but the two crank pins are supposed to be connected by a rigid member (not shown), and crank $c^2$ is rigid with a spider which carries the bevel pinions of the differential. Consequently the power applied to both crank pins acts on the bevel pinions of the differential. The left-hand bevel gear of the differential is made fast with the adjacent half of the rear axle, and impels the left rear wheel direct. The right-hand bevel gear is made fast with the spur gear $c^9$, which turns independently of the crank $c^2$. A spur pinion $c^8$ meshes with this gear, and is keyed on a short shaft, extending through the crank pin and carrying a sprocket pinion on its inner end. A short sprocket chain connects this with similar sprocket and spur pinions on the other crank pin, engaging another spur-gear $c^5$, which is fast on the inner end of the right-hand rear axle. Consequently, if we suppose the cranks to be stationary and that the left-hand rear wheel is rotated backward, this will, through the differential, rotate the gear $c^9$ forward; and the pinions on the crank pins will

Fig. 1.

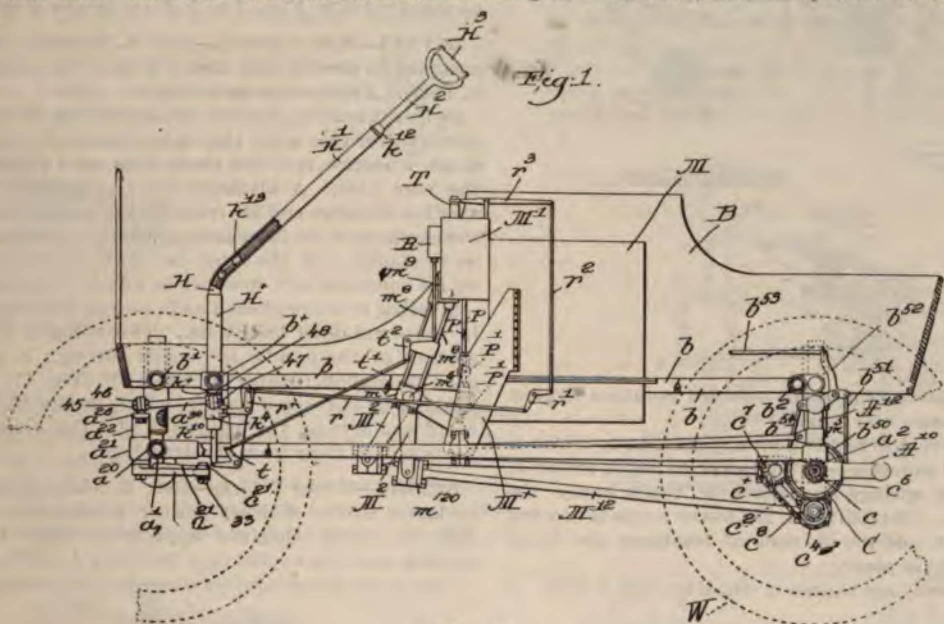


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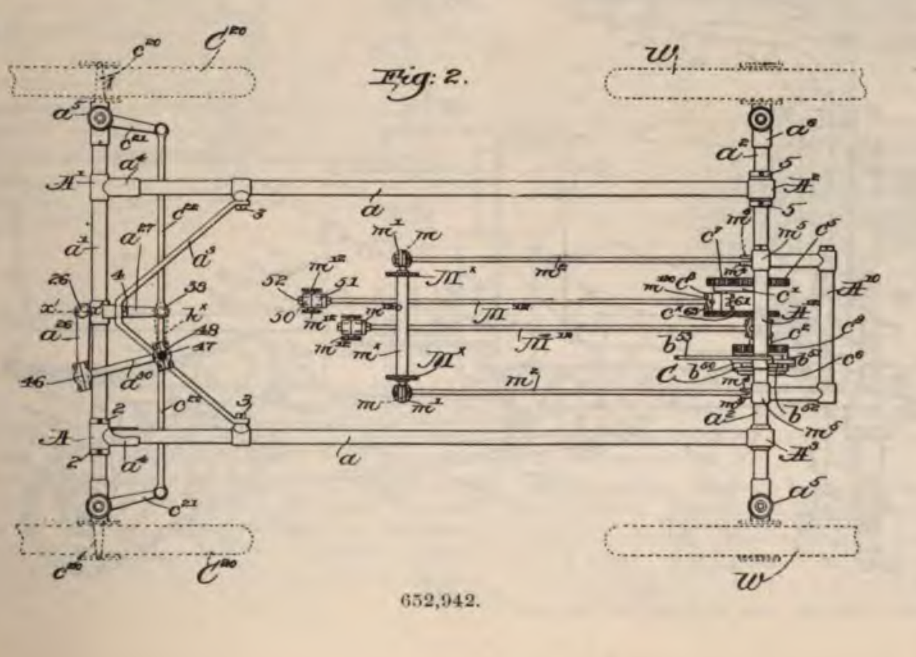
Fig: 2.



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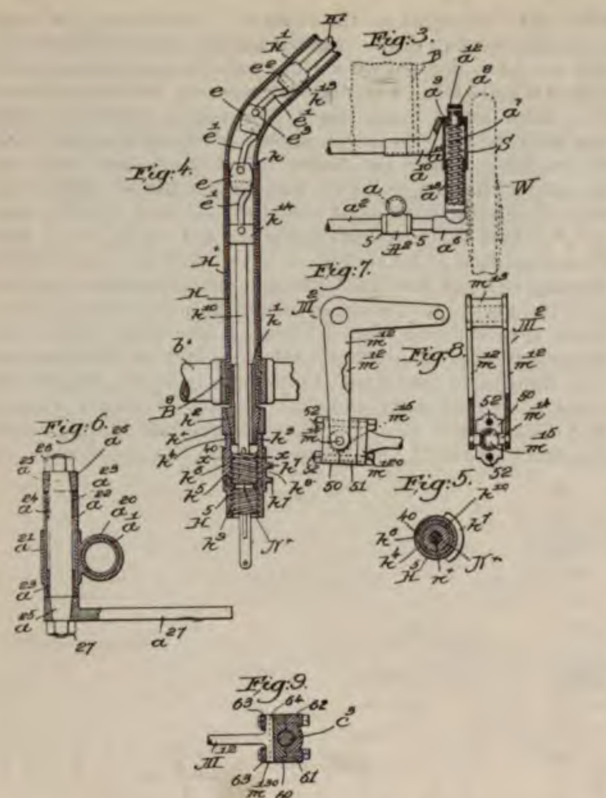



652,942.

rotate backward and communicate forward rotation to gear $c^5$ and to the right-hand rear wheel.

The body B of the vehicle rests on an upper frame b, which is spring-supported at points $a^5$ on the lower or main frame a. Helical compression springs in telescopic tubes carry the weight of the body. Flexibility of the lower frame is secured by loose joints at A and $a^4$, tie rods $a^3$ retaining the front transverse member $a^1$ in place.

The controlling means are shown in detail in Figs. 4 to 6. A short arm $h^x$, near the foot of the steering head H acts on another arm $a^{26}$ through the medium of a ball-jointed link $a^{30}$. This turns a vertical shaft $a^{24}$ (Fig. 6), and swings an arm $a^{27}$, to which are linked the steering arms $c^{21}$. A nut $h^4$, screwed up tight on the lower end of the steering head, is internally threaded with rather steep pitch, as shown in Fig. 4. It has a tongue or feather $h^6$ (Fig. 5), and a sleeve $H^5$ is free to slip on it in a vertical direction. This sleeve is internally threaded in the opposite direction, and a right and left hand screw $N^x$, when rotated by the feather on the stem or rod $h^{10}$, causes the sleeve $H^5$ to move up or down on $h^4$. This sleeve has on its outer surface two lips $h^7$, by which it acts on one arm of a bell crank $r^x$ (Fig. 1) and thereby on the throttle of the engine, through suitable links and levers. Reversal of the engine is obtained by pushing on the handle $H^3$, whereby the stem $h^{10}$ is made to act on the bell crank t.

To allow for perfect freedom of relative motion between the engine and the rear axle, the connecting rods $M^{12}$ are made with ball and socket ends, the pins on which they work being found to admit of this. Figs. 7 to 9 show details of this construction.

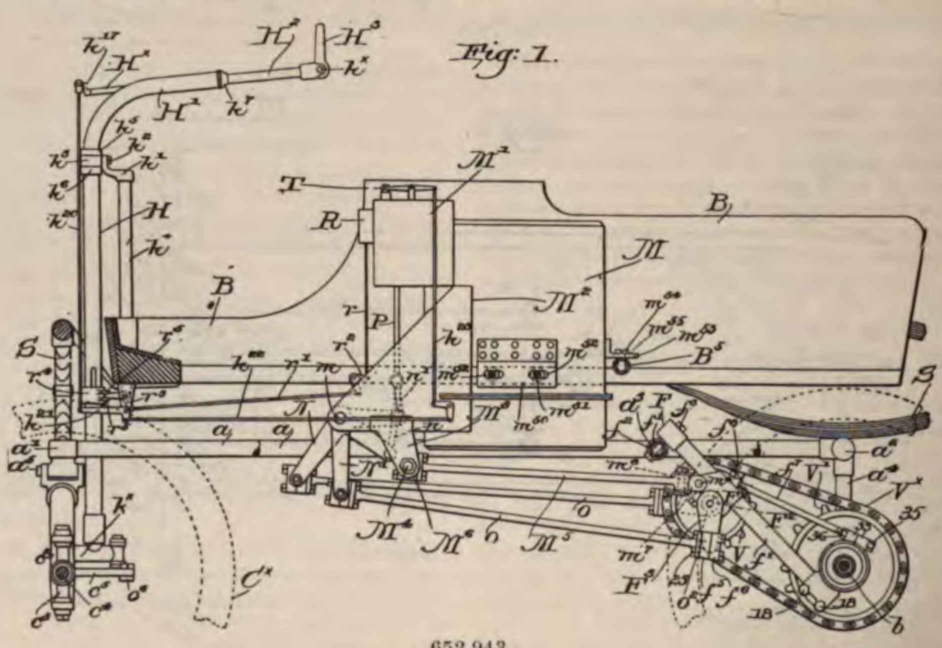
652,943—Motor Vehicle.—Geo. E. Whitney, of Boston, Mass., assignor to the Whitney Motor Wagon Co., of same place. July 3, 1900. Application filed June 10, 1899.

In this invention, instead of connecting the bell cranks $NN^1$ direct to the rear axle, they are connected to an intermediate shaft, whence a sprocket chain acts on a differential drum on the rear axle. A distance rod $f^7$ tightens the chain, and another distance rod $M^5$ reserves the proper distance between the engine and the intermediate shaft. The engine is mounted on the boiler, and the later can move a little forward or back on its supports $m^{50}$, in order to admit of the chain tightening.

Steering is accomplished as in patent No. 652,940, published in these columns last week. Throttling is accomplished by motion of the handle $H^3$, which through a segmental bevel gear and pinion, rotates the shaft $h^{16}$ (Fig. 4). Reversing is by pushing on the same handle, which moves the rod $h^{27}$ downward and acts on the bell crank $r^3$. The arrangement of the parts will be clear from the drawings.

652,944—Motor Vehicle.—Geo. E. Whitney, of Boston, Mass., assignor to the Whitney Motor Wagon Co., of same place. July 3, 1900. Original application filed April 30, 1897. Divided and this application filed May 4, 1900.

This invention comprises some details of construction, which

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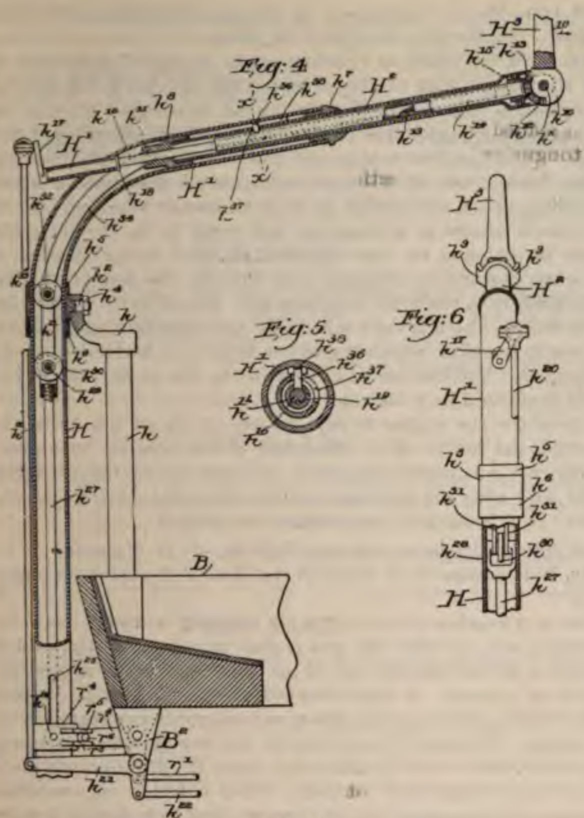
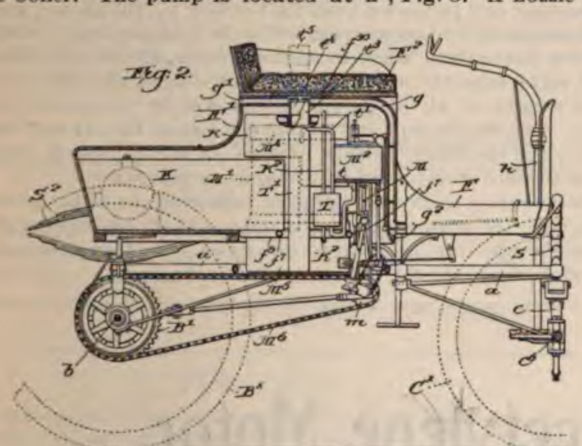


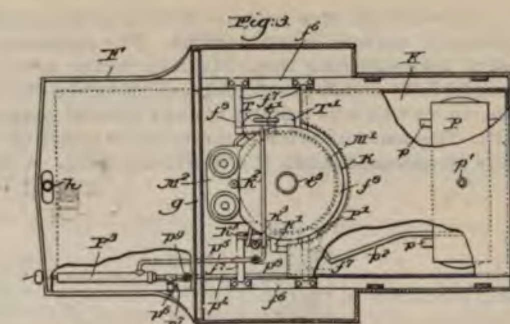
622,943.

will be noted by reference to the drawings. A passage or flue g, for cold air, is interposed between the top of the boiler and the seat. This is open at $g^2$, so that air enters when the carriage is running. A water jacket k covers the top of the boiler, and the feed water is thereby heated before being pumped into the boiler. The pump is located at $k^3$, Fig. 3. A nozzle $p^6$,



652,944.

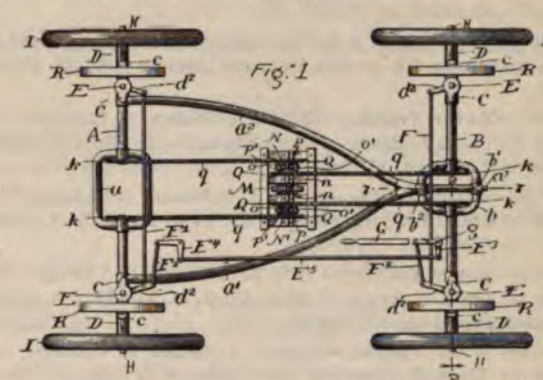
with a valve $p^7$, permits the attachment of a hose; and by the pump $P^2$ water may be pumped either into the boiler or into the tank. The gasoline tank P is placed inside the water tank, thus saving space and protecting the tank from fire. The exhaust from the engine passes through the muffler T, and thence to the top of the flue $T^1$. The burned gases from the boiler enter this flue and are driven downward by he steam. When starting the carriage, the cover $t^{30}$ in the seat may be removed and the gases allowed to escape upwards by the flue $t^4$.

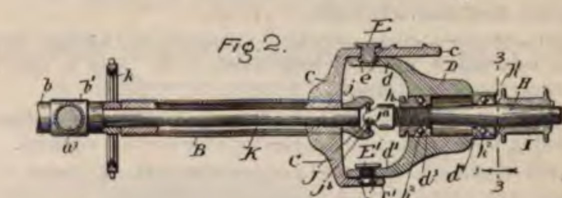


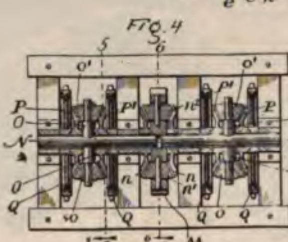
652,944.

652,949—Running Gear for Automobiles.—Chas. Cotta, of Shannon, Ill. July 3, 1900. Application filed Jan. 17, 1900.

The object of this invention is to enable power to be applied to all four wheels, while at the same time all four wheels may be deflected for steering purposes. To this end a differential mechanism is used of the character shown in detail in Fig. 4. Power is applied to the spur gear M, by which a compensating drive is applied to the two shafts $NN^1$. Each of these latter carries a spider O, with bevel pinions acting on bevel gears







652,949.

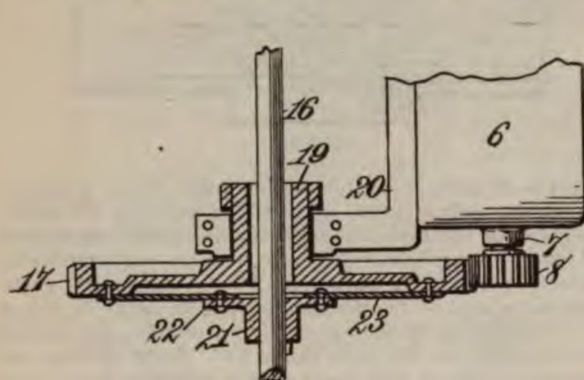
made fast to the sprocket wheels Q, which revolve freely on the shafts $NN^1$. Steering is effected in the manner shown, and power is communicated to the wheel hubs through universal joints, as seen in Fig. 2.

653,040—Gas Engine.—T. B. Royse, of San Miguel, Cal. July 3, 1900. Application filed June 14, 1898.

653,102—Motor Vehicle.—Chas. A. Lieb, of New York, N. Y. July 3, 1900. Application filed May 6, 1899.

The object of this invention is to provide a flexible connection between the rear axle and the gear which drives it, such that

the gear may always run true with its driving pinion regardless of the wear of the axle in its bearings. The figure shows one method of accomplishing this. Six is an electric motor, 8 its pinion, and 17 the driven gear. This gear runs in a bearing in the frame, so that its axis remains always parallel with the motor shaft. The gear hub is made large, and is bored out so that the axle 16 passes through it without touching. A flexi-




653,102.

ble connection, such as a leather disc or an arrangement of springs, transmits the power from the gear to a flange 22 on the axle.

653,167—Motor Vehicle.—Clyde J. Coleman, of Chicago, Ill., assignor to Thos. J. Ryan, of New York, N. Y. July 3, 1900. Application filed Aug. 11, 1899.

653,168—Motor Vehicle.—Clyde J. Coleman, of Chicago, Ill., assignor to Thos. J. Ryan, of New York, N. Y. July 3, 1900. Application filed Aug. 11, 1899.

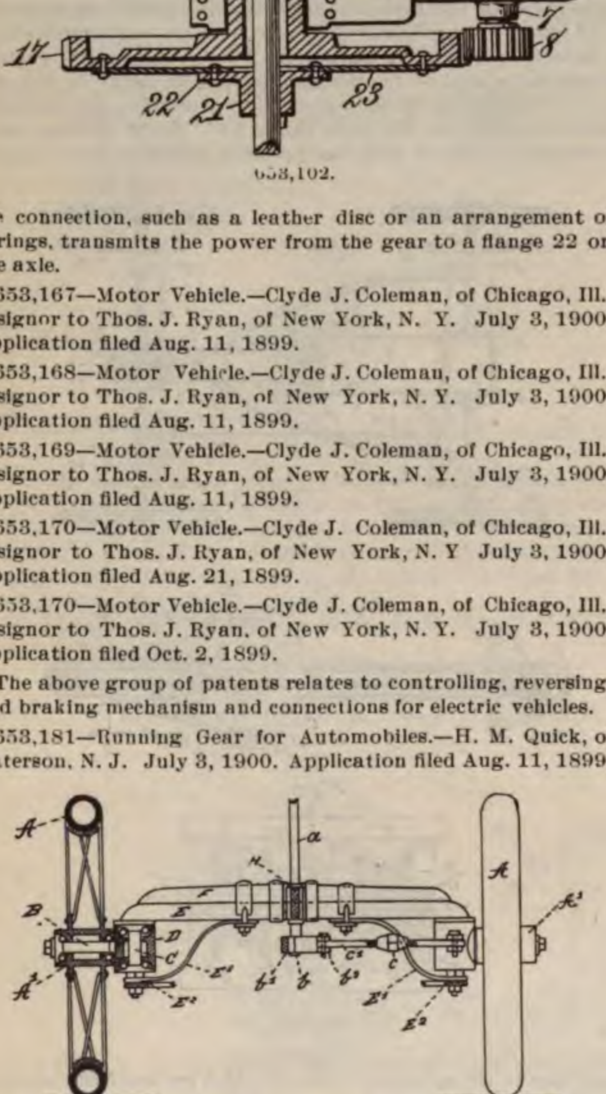
653,169—Motor Vehicle.—Clyde J. Coleman, of Chicago, Ill., assignor to Thos. J. Ryan, of New York, N. Y. July 3, 1900. Application filed Aug. 11, 1899.

653,170—Motor Vehicle.—Clyde J. Coleman, of Chicago, Ill., assignor to Thos. J. Ryan, of New York, N. Y July 3, 1900. Application filed Aug. 21, 1899.

653,170—Motor Vehicle.—Clyde J. Coleman, of Chicago, Ill., assignor to Thos. J. Ryan, of New York, N. Y. July 3, 1900. Application filed Oct. 2, 1899.

The above group of patents relates to controlling, reversing, and braking mechanism and connections for electric vehicles.

653,181—Running Gear for Automobiles.—H. M. Quick, of Paterson, N. J. July 3, 1900. Application filed Aug. 11, 1899.



653,181.

The principal feature of this invention is in the form of the front axle, which is downwardly bent at the ends, as shown in the drawing, to form the vertical pivots about which the steering axles swivel. The steering arms, links, etc., are of the usual description.

653,199—Motor Vehicle.—J. H. Munson, of Chicago, Ill. July 3, 1900. Application filed May 16, 1898.

This is of the class of "combination systems" described in The Horseless Age of May 9 last. The armature of an electric dynamo, convertible into a motor, is coupled directly to the shaft of the gasoline engine, to which it serves as a flywheel. When the vehicle is in use, the electric machine, drawing current from a set of storage batteries on the vehicle, is the propelling agent, the engine at such times not running. When the vehicle comes to a stop, on the road or in the barn, the engine is clutched to the motor shaft, and, being started, it drives the motor as a dynamo and charges the batteries. To accomplish this, the field magnets are wound with two coils, one in series, which is used when the machine acts as a motor, and one in parallel, which is excited when the batteries are to be charged. The change of current from one to the other field circuit is effected by a switch.

In practice the engine is said to be of about one-third the power of the motor when the latter is exerting its maximum power. An automatic-magnetic cut-out opens the charging circuit and also the igniting circuit when the voltage of the battery equals that of the dynamo charging it.

653,200—Independent Motor Vehicle.—J. H. Munson, of La Porte, Ind., assignor of one-half to Wm. F. Roberts, of same place.

This is a combination system of another variety than the preceding one, in that the gas engine runs constantly, and is made of a power slightly exceeding that required to propel the vehicle on a level. A shunt-wound electric motor is coupled to the engine, and a small storage battery is connected with the motor. The motor is driven by the engine while the car is in motion, and is so constructed that it will operate as a dynamo to charge said battery. When a hill is encountered, the speed of the engine will be checked, and in consequence the voltage of the motor will drop below that of the battery, and current will return from the battery to the motor to rotate the armature thereof and assist in the work of the engine. The motor has a capacity little less than that of the engine, and the two operating together will drive the car upon the grade. As the speed of the engine is increased, owing to the assistance of the motor, the power of the engine will be increased, and hence less current will be drawn from the battery by the motor, and for this reason, and because electricity is consumed only when starting the car and when mounting grades, the battery may be of small capacity and hence of light weight, and the combined weight of all of the equipment will be comparatively small. The electric motor is employed to start the car and the engine, and the latter quickly attains its normal speed, after which the motor automatically becomes a generator.

The invention is shown as applied to a tram car of the usual form, with the engine and motor on one shaft and connected by single-reduction gearing to the axles. Two engines and two motors are shown, one set for each axle.

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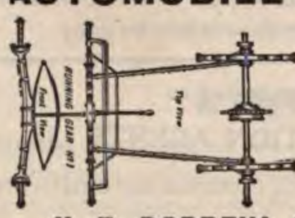

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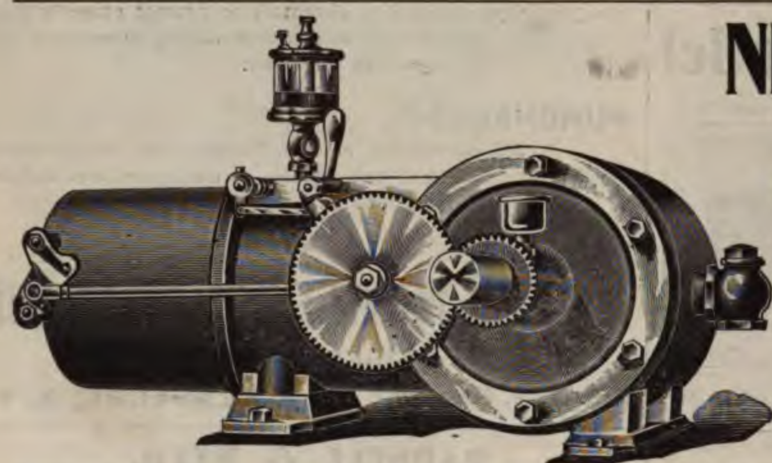

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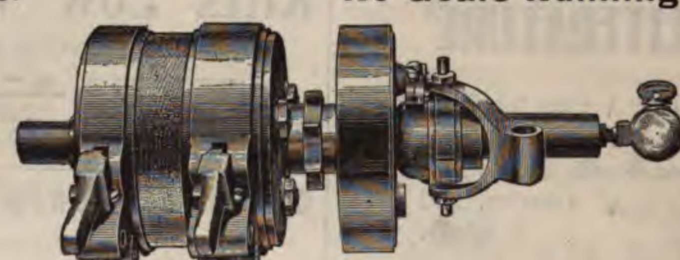

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# THE HORSELESS AGE

...EVERY WEDNESDAY...

Devoted to Motor Interests

VOLUME VI NEW YORK, AUGUST 8, 1900 NUMBER 19



# THE HORSELESS AGE.

E. P. INGERSOLL, EDITOR AND PROPRIETOR.

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## THE OUTLOOK FOR STEAM TRACTION.

WE regret that, up to the date of publication of this issue, we have received no better report of the discussions held at the meetings of the recent Automobile Congress than the obviously prejudiced account from the London *Engineer* reprinted on another page. That journal has before now displayed something very like gratuitous hostility toward automobilism, and this fact needs to be borne in mind when reading its utterances regarding it.

Whatever may really have been said, in the discussions referred to, regarding the use of steam for the propulsion of road vehicles of medium weight, we find it impossible to believe that the last word has been said on this subject. If we estimate the present combined output of steam pleasure carriages in this country at 30 per working day, we shall probably be well within the mark. But three years ago, the man who predicted that steam carriages would be used with success by the unmechanical public, and that factories turning out over a thousand a year would be unable to keep pace with their orders, would have been regarded as a dreamer or a crank. And yet there is every indication that, as the details of these carriages are perfected, the demand for them will steadily increase, and will be extended to the Old World as well. Viewing the wonderful change here wrought from the uncouth locomotive-like affairs of previous experimenters, who will say that a similar transformation is not awaiting the heavier vehicles for public transportation and for commercial trucking? If one eminent speaker at the Automobile Congress found that his 14,000 franc steam vehicle cost him 15,000 francs for repairs, and that it had to be scrapped in five years, we are sorry for him, of course; but *pace* our contemporary, we decline to believe that the question is thereby settled

Indeed, the statistics published recently by the Liverpool *Journal of Commerce*, and quoted in our columns, would go far to prove that "satisfactory vehicles" for commercial work are now being turned out by at least one firm in England. Certainly a firm like the one giving the figures in question, would not be likely to be led far astray by unreasoning enthusiasm. It will be noted that in these figures the depreciation is put at 15 per cent., giving an estimated life of about seven years. This may or may not be too long a life to assume under the conditions of the case in question, but there seems no reason for putting it down as unattainable. It must be remembered that this vehicle was built to conform to the Light Locomotives Act, which means that its weight, empty, is not over three tons, and that higher cost of construction and quite possibly shorter life are involved in this fact.

The remark attributed to M. Forestier in the article quoted, to the effect that the steam vehicle could never be as economical as the draught horse, "because the latter was capable of doing 5,000 times its weight in work in the course of a day, sounds strangely in the mouth of an engineer, since in the absence of the other factor by which work is measured—the distance through which the force acts—the expression is wholly meaningless. Probably M. Forestier is the victim of a misquotation; and his meaning appears to have been that the horse is a more efficient converter of energy than the steam engine is. If this was what he said, however, his objection impresses us as purely academic. We all know that the "hay motor" is a far more efficient transformer of energy than the steam motor. If hay were as cheap as coal, and if the hay motor could propel the vehicle as fast as the steam motor, that might possibly settle it. Not only is the hay motor hopelessly worsted on the latter two counts, however, but the

attendant wages cost is an item militating heavily against him. We believe that it is not considered economical, in city haulage, to put more than two horses in a team, except when the nature of the load is such that it cannot be divided into two-horse units. This means that a driver, and possibly an attendant, must go with every two-horse load. Again, the horse needs frequent rest, which the steam motor does not. He will get a good deal of this during the intervals of loading and unloading; but no horse can be kept in the harness thus all day long; and this means one or more relays of horses, with the added investment, attendance, and expense thus involved. The horse is "not in it" with the steam pleasure carriage; and when "satisfactory vehicles" for passenger transportation and trucking are developed, there will be but one opinion as between the horse and steam power for heavy work.

WHAT with the Automobile Exhibition and Race Meet at Chicago, in September, under the auspices of the Inter Ocean, the track races at the Inter State Fair at Trenton, N. J., later in the same month, and the automobile exhibition in Madison Square Garden, New York, under the auspices of the Automobile Club of America, with the connected tests, the motor vehicle will be prominently before the public during the autumn. The tests proposed are of a practical nature and will be of great value to builders and users. We are glad to note that such racing as is proposed is to be done on the track and not on the highway.

THE interesting letter from Prof. Foote, in another column, suggests that readers of THE HORSELESS AGE can help each other out materially by making public the routes which they have found to afford agreeable trips, as well as by warning tourists against roads of the other sort. Information of this sort, with items as to tolls, entertainment en route, etc., is always apropos, and we will be glad to lend our columns to its publication.

## FIFTH AVENUE MOTOR STAGE SERVICE TO BE EXTENDED.

The New York State Railroad Commission has granted the application of the Fifth Avenue Coach Company to extend its route to 135th street. It now terminates at 89th street.

It is also proposed to run a branch line from West 57th street and Fifth avenue to Broadway, to West 72d street and to Central Park West.

Another branch is proposed to run from Fifth avenue and 110th street, along Cathedral Parkway, to Riverside Drive. Still another branch will be operated from Broadway at 72d street to Riverside Drive, and thence northerly to 124th street, past Grant's Tomb. All applications were granted.

The fares will be 10 cents on the line running from Bleecker street through to 135th street, including transfers to the several branches. The fares on the branches or shorter lines will be 5 cents.

## A PROTECTIVE ASSOCIATION FORMED.

The meeting of manufacturers of gasoline motor vehicles and of motors for automobiles, which was called for the purpose of forming an association to fight the Selden patent, owned by the Electric Vehicle Co., took place at the Iroquois Hotel, Buffalo, August 2d.

The preliminary session was called to order at 10:30 a. m., with twenty-odd manufacturers of vehicles and motors in attendance. A committee on credentials was elected at once and passed on the credentials of all present. One representative of an electric concern was "excused," and the meeting was confined to gasoline people exclusively.

After a two-and-a-half-hour discussion of the merits of the Selden patent and the necessity of an association, a committee on organization was appointed, and the meeting adjourned till four o'clock.

At that time the members re-assembled and passed on the report of the committee in short order, adopting it in its entirety.

The committee made nominations for officers, and the nominees were all unanimously elected as follows:—President, Elmer Apperson, of the Haynes & Apperson Co., Kokomo, Ind.; Secretary, George H. Brown, of the Winton Motor Carriage Co. Cleveland, O.; Treasurer, John F. Harper, Treasurer of the Colonial National Bank, Cleveland, Ohio. Executive Committee: E. B. Gallaher, of the Keystone Motor Co., Philadelphia, Pa.; H. M. Sternberg, of the Duryea Power Co., Reading, Pa.; A. Snyder, of the Buffalo Gasoline Motor Co., Buffalo, N. Y.; John S. Clarke, of the Autocar Co., Ardmore, Pa.; and the President, Secretary and Treasurer.

After the election of officers, all those present attached the signatures of their firms to the articles of agreement which had been adopted. In addition to the membership secured at the first meeting, a large addition is expected from firms who wrote pledging themselves to abide by any action that might be taken by the meeting.

By five o'clock the work was completed and the meeting adjourned subject to the call of the Executive Committee. Further information, the meeting decided, it would be undesirable to give out at the present time. It may be stated, however, that every manufacturer present appeared to be thoroughly in earnest in his opposition to the Electric Vehicle Co.'s attempt to monopolize the business, and determined to stand by the Winton and Buffalo companies in their fight; and these two companies, on their part, pledged themselves to make no compromise in the pending litigation.

## ELECTRIC STAGES IN CENTRAL PARK.

Four electric park carriages have begun regular trips through Central Park from 72d street and Fifth avenue to West 72d street, to Riverside Drive, and up the drive to Claremont. Ten cents fare will be charged from Fifth avenue to the lower end of Riverside Drive. The round trip to Claremont and return will cost, as now, 25 cents. The coaches are nearly identical in appearance with the present carriages. They will carry 12 passengers and make the round trip in an hour.

Upon the success of this new crosstown automobile service hinges the equipment of another route. The Central Park carriage service, which controls the Riverside Drive route, also has charge of a belt line entirely within the confines of Central Park, and four electric stages will be placed upon that route if the present service is successful. They will start from the Plaza at Fifth avenue and 59th street and traverse the East Drive, passing the Casino, the Obelisk and the Art Museum. They will cross over from east to west at 106th street, and return by the West Drive to the Plaza. The round trip fare of 25 cents will be continued, and it is hoped that with the automobiles the journey may be made in less than an hour.

The present stages were started a score of years ago. At that time the hackmen charged exorbitant rates for service in the Park, and the Park Commissioners began to run the stages.

## ANOTHER SURVIVAL.

The red-flag law is still to be found on the statute books of Vermont State. Section 3,526 reads as follows: "The owner or person in charge of a carriage, vehicle or engine propelled by steam, except road rollers, shall not cause or permit the same to pass over, through or upon any public street or highway, except upon railway tracks, unless he sends, at least, one-eighth of a mile in advance of the same, a person of mature age to notify and warn all persons traveling upon or using the street or highway with horses or other domestic animals; and at night such person shall, except in an incorporated village or city, carry a red light. A person violating the provisions of this act shall be fined not more than $10 for each offence."

## THE LATEST DURYEA MODEL.

The accompanying photograph shows the latest Duryea product, now being turned out by the Duryea Power Co., of Reading, Pa. Its makers claim unusual speed for it, and, though it weighs but 650 pounds, yet it is strongly constructed throughout. The wheels are 30 and 36 inches in diameter, with 1¼-inch spokes and 3-inch tires. The rear axle extends through both wheels, the drive chain is of the self-oiling pattern, and the foot-brake has power sufficient to slide the wheels in either direction. The steering is effected by a single lever, pivoted to the front edge of the seat, and controls the steering wheel without lost motion. The motor throttle and gear clutches are operated by the same handle, and as this handle is between the riders, it may be manipulated by either rider at will. The mechanism is all enclosed within the body, and by raising the seat, like a trunk lid, every thing is exposed for inspection and repair. The sloping dash deflects the air downwards, rendering high speed less uncomfortable than in many vehicles. Side curtains and storm aprons make the vehicle rain-proof for doctor's use or for touring, while the large tires and long springs insure comfortable riding. The regular three-cylinder motor is used, with magneto ignition and compact hill-climbing gear, but all ordinary speeds are secured simply by throttling the motor. All the bearings are self-oiling, except the cylinders, which have large oil cups affixed. Water circulation is obtained without using a pump, and the fuel tank, carries gasoline for a run of 100 miles.

## GASOLINE ON FERRY-BOATS.

The following is the text of that section of the Revised Statutes on which Supervising Inspector General of Steam Vessels Dumont has decided that gasoline vehicles cannot be transported by ferry-boats. It is No. 4,472, and it reads thus:

No loose hay, loose cotton, or loose hemp, camphene, nitro-glycerine, naphtha, benzine, benzole, coal oil, crude or refined petroleum, or other like explosive burning fluids, or like dangerous articles, shall be carried as freight or used as stores on any steamer carrying passengers; nor shall baled cotton or hemp be carried on such steamers unless the bales are compactly pressed and thoroughly covered with bagging of similar fabric, and secured with good rope or iron bands; nor shall gunpowder be carried on any such vessel, except under special license; nor shall oil of vitriol, nitric or other chemical acids be carried on such steamers, except on the decks or guards thereof, or in such other safe part of the vessel as shall be prescribed by the inspectors. Refined petroleum, which will not ignite at a temperature less than 110 degrees of Fahrenheit thermometer, may be carried on board such steamers upon routes where there is no other practicable mode of transporting it, and under such regulations as shall be prescribed by the board of supervising inspectors, with the approval of the Secretary of the Treasury; and oil or spirits of turpentine may be carried on such steamers when put in good metallic vessels, or casks or barrels, well and securely bound with iron, and stowed in a secure part of the vessel; and friction matches may be carried on such steamers, when securely packed in strong, tight chests or boxes, the covers of which shall be well secured by locks, screws or other reliable fastenings, and stowed in a safe part of the vessel, at a secure distance from any fire or heat. All such other provisions shall be made on every steamer carrying passengers or freight, to guard against and extinguish fire, as shall be prescribed by the Board of Supervising Inspectors, and approved by the Secretary of the Treasury.

The law governing automobile traffic on steamboats and ferryboats was brought to public attention recently at Newport, where the interesting matter to decide was if the motor carriages should be allowed to cross on the ferryboats running to Jamestown, which is situated about in the middle of the harbor. The place is smaller than Newport, and a little less fashionable, nevertheless it is a resort of many well-known families, and is a place often visited by residents from the mainland. The only way by which it can be reached is steamboat or ferry. When the Inspector-General made his decision regarding "autos" operated by naphtha or gasoline, he effectively treated the matter of their passage to and fro, but then the finer point was brought forward, "Shall steam motors, in almost all of which the flame is supplied by gasoline, be allowed the privilege denied the other vehicle?" The law reads "no explosive burning fluids," but so little gasoline is used in the small tanks attached to steam motors that it was thought all danger was at a minimum and the latter type of carriage would be exempt.

This question was broached to the Boston-United States Inspector of Steam Vessels last week, and he made no hesitation in answering that no matter what quantity of gasoline is used, it comes under the section printed above, therefore is subjected to the same conditions as those governing a gasoline carriage.

There also was another interesting side to the question. The City of Boston is the owner of a gasoline carriage, and also it has the control of a ferry-boat. The inspector was asked whether or not, if the city so desired, it could transport its carriage on the city ferry-boat. He replied that inasmuch as the ferry-boat of any city comes under the rules and regulations of the United States steamship laws, all matters concerning its freight also come under United States laws, so that the city is no more favored than the individual. There is, however, a special clause applicable to this city, which allows it to transport kerosene oil in limited quantities from East Boston to the Boston side on the regular ferry-boats, although it is provided that it shall be safely stored at a point on the boat farthest away from the boilers and best suited to the safety of passengers. Though the law has to be enforced, some of the authorities are inclined to think that so far as the carriages in which steam is generated by a gasoline flame are concerned, there is practically no danger.

## AUTOMOBILISM AT THE PARIS EXPOSITION.--IV.

By P. M. Heldt.

The Marot-Gardon vehicle, shown in our illustration of the Marot-Gardon stand at the Exposition, and in the accompanying drawings, is intended to fill the demand for a vehicle intermediate between the high-priced, complicated road vehicles, built by the large firms in France, and the light, fragile, and often uncomfortable voiturettes. To all appearances this vehicle fulfills the requirements that one would make of such a machine. The form of construction is of a substantial character, and the price is reasonable for French conditions.

The frame is of V-iron, assembled in such a manner that the longitudinal pieces form a flush joint with the transverse pieces, the whole being riveted together by means of elbows of sheet steel. The frame is suspended by four semi-elliptic springs. Distance rods are attached to the rear axle and to the gear box. The distance between the rear axle and the differential shaft is, therefore, not altered by the tension of the chains, but remains always the same.

The pivots of the steering spindles slant rearwards, a construction which is claimed to be patented.

This method of constructing the steering spindles will permit turning corners at high speed within a diameter of 25 feet.

The motor is of the horizontal, water-cooled, double-cylinder type. The bore of the cylinders is 3.4 inches and the stroke 4.8 inches, the normal speed being 700 revolutions per min. The rating of the motor is 4½ h. p., but it is claimed that on brake test they will give from 4.7 to 4.9 h. p. The valve chambers are fastened to the cylinder head, and the intake as well as the exhaust is operated mechanically. The ignition is of the regular jump spark type, and can be shifted at will. A little switch in the igniter circuit is placed on the steering hand-wheel, and permits the operator to stop the sparking instantly. The carbureter used with this motor is of the constant level type. The levers for advancing the ignition, and for regulating the carburation, are located just below the steering hand-wheel, as will be seen from Fig. 2.

The shaft A is geared to the motor shaft by a bevel gear and pinion, and it transmits the power to the Megy friction clutch B, the shifted sleeve C of which is operated by a foot lever. The friction clutch lever is so connected to the brake lever that when the latter is operated, the clutch disengages automatically. The shaft D ends in a squared portion E, on which slides a double bevel pinion, used for reversing the motion of the vehicle.


Fig. 1. Marot-Gardon Carriage.

The shaft J, which receives its motion through the bevel pinions F or G, carries three friction clutches, K, L and M. Each of these friction clutches has attached to it a spur gear, which engages with a corresponding spur gear on the differential shaft N. At the middle of this shaft will be noticed the combined differential gear and brake drum, and at the ends the sprocket pinions. This method of changing speed by means of friction clutches, which is distinctively American in origin, is as yet very little used in France, the only other vehicle here using it, of which the writer knows, being the light one of de Dion & Bouton.* It will be noticed that there are three disconnecting couplings in series between the engine and the wheels,

* See The Horseless Age, issue of April 11, 1900.

viz., the friction clutch B, the double bevel gear F, G, and the friction clutches K, L and M. As a special advantage of the friction clutch speed change, it is claimed that when going at full speed, and throwing in the low-speed gear, the motor can be made to act as a very powerful brake.

All the gears and clutches are enclosed in a casing, with a door to permit easy access and inspection. The operation of the friction clutches is effected by means of a rack and a gear sector.

The steering gear is operated by means of a hand wheel fastened to an inclined steering rod. This rod is provided at its the casting. At the extremity of the levers, pins pass through them, which act as guides for coiled springs. These springs are contained in hollow cylinders, open at one end, and sliding in a drilled hole in the casting. A tapered pin, forced between these cylinders, will act on the levers through the intermediary of the springs, and thus expand the ring, making it grip the outer drum.

The cooling water is passed through radiating coils on the bonnet placed over the engine in front of the vehicle. A special rotary pump, illustrated in Fig. 6, is used for circulating the water. The pump consists of a chamber, in which two meshing

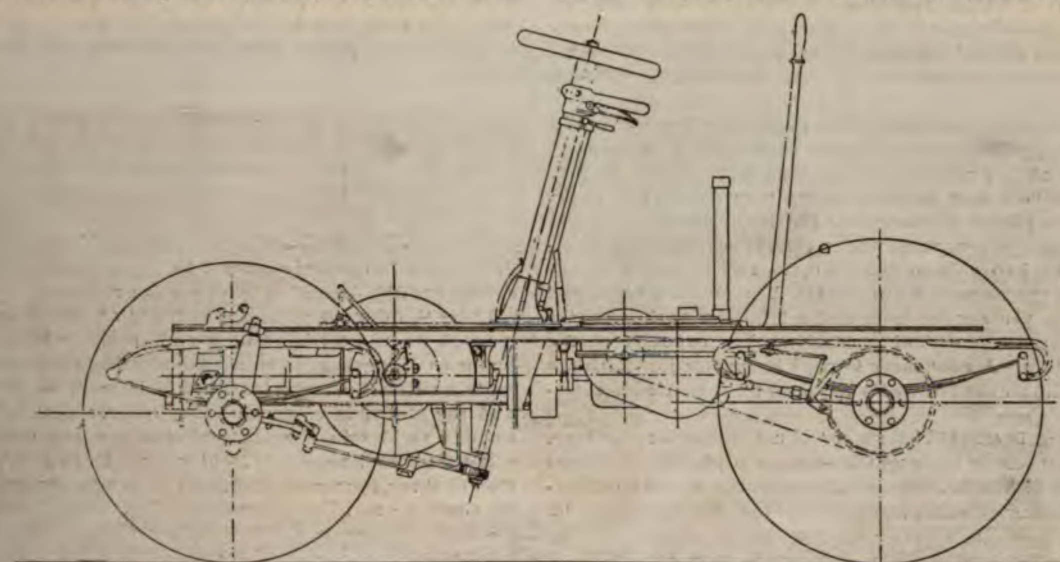

FIG. 2. ELEVATION OF MAROT-GARDON RUNNING GEAR.

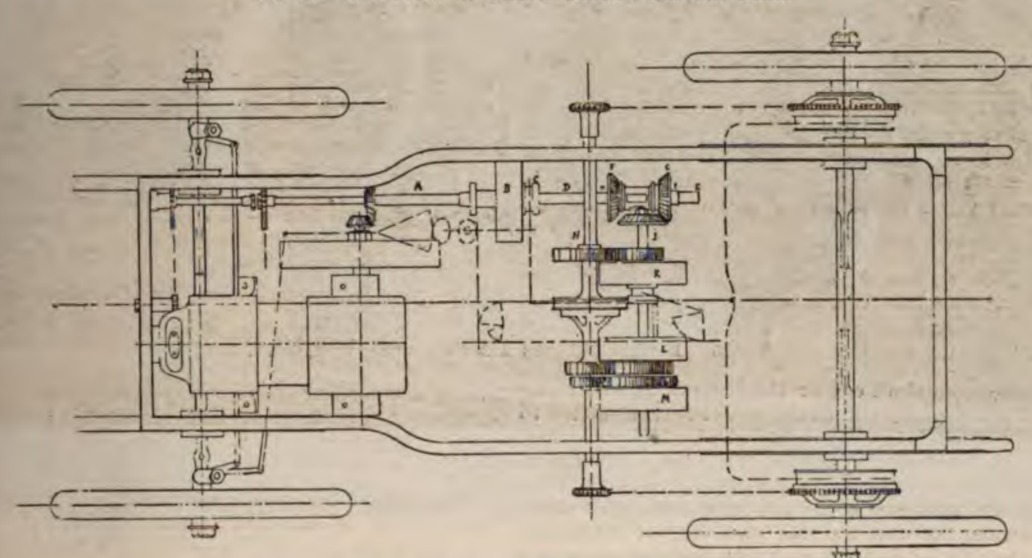

FIG. 3. PLAN OF MAROT-GARDON RUNNING GEAR AND MECHANISM.

lower extremity with a pinion, engaging with a gear sector on one arm of a double-armed lever. The other arm of this lever is joined to the lever of the steering spindle by means of a connecting rod or link.

The friction clutch deserves special mention. It consists of an outer drum, to which the gear is fastened, and which ordinarily turns loose on the shaft, an inner expansible ring, and a casting keyed and pinned to the shaft. The expansible ring carries two lever supports, in which are hinged single-arm levers, which fulcrum on opposite ends of a pin passing through spur gears rotate. The water enters at one side of the chamber and is carried along by the teeth of the gears around the surface of the chamber, leaving at the side opposite from where it entered. This little pump weighs only 7.65 pounds. It is driven through a chain at 800 revolutions per min., and it will lift the water 24 inches.

The following are some further data of the machine. The three speeds are 5, 11 and 22 miles an hour; the backing speeds are the same; the track is 46 inches, and the wheel base 64 inches; the diameter of the front wheels is 28 inches, that of

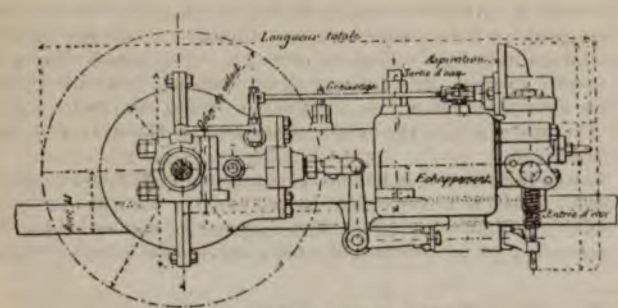

FIG. 4. MAROT-GARDON MOTOR.

the rear wheels 32 inches; the wheels are tired with pneumatics of 3½ inches diameter. The gasoline reservoir has a capacity of 6½ gallons and the water tank holds 9 gallons.

In Fig. 7 is shown a heavy steam wagon, in which all four wheels are drivers, and have ordinary iron tires. The boiler and engine are placed in front, near the driver's seat.

The boiler is of the upright water tube type, and has a heating surface of 110 square feet. Liquid fuel is used, and the regulation of the burners is automatic. The pressure employed is 200 pounds per square inch, and a triple-expansion engine is used to obtain economical operation. The capacity of the engine is 12 h. p. A condenser is used in connection with the engine, and the amount of water required to be carried is therefore small.

The steering is effected by means of a turning forecarriage, having a gear sector with which engages a pinion. A worm and wheel are placed in the steering mechanism to make it irreversible. Two different speed reductions are obtained by clutching to the engine shaft one or the other of two different-sized sprocket pinions. By chains the power is transmitted to an intermediate shaft below the vehicle body, in front. This intermediate shaft carries, besides the two sprocket wheels, which are chain driven from the engine shaft, a sprocket for a third chain, transmitting power to a rear differential shaft, a bevel pinion, gearing with another on a vertical shaft, concentric with the axis of swiveling of the forecarriage, and a brake drum. The vertical shaft just mentioned transmits motion to another horizontal shaft, by means of bevel gears, and this short horizontal shaft is chain-connected to a front differential shaft. The two differential shafts have sprocket pinions at their ends, and four chains transmit the power to the wheels.

It is claimed that this vehicle will turn with the forecarriage at right angles with the vehicle, and that it will start from rest when standing in this manner.

The weight of the vehicle is 5,500 pounds, and it will carry a load of 6,600 pounds, besides drawing a trailer carrying 4,400 pounds. The consumption of kerosene when the vehicle is drawing a full load is from 1 to 1⅓ gallons per hour. The speeds are 2½, 5 and 7½ miles per hour.

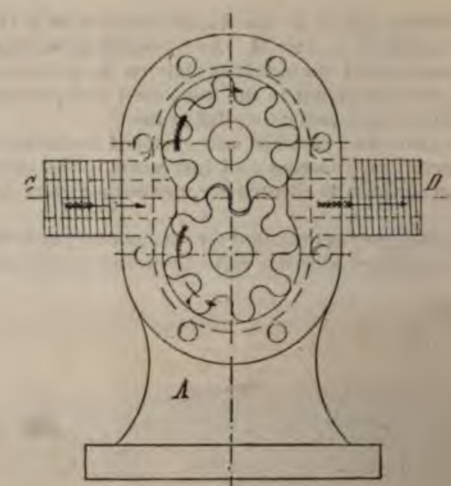

FIG. 6. ROTARY PUMP.

Louis Gautier, of St. Malo, exhibits at the Champ de Mars a truck or frame with motor and transmission. The vehicle has a combination driving and steering front axle, and presents a number of novel features. The frame is of steel tubing, and the motor is of the single-cylinder, air-cooled type. The novelty resides in the transmission gearing, consisting of a constant speed reduction, which may have a ratio of reduction of three, four or any higher whole number, and of a variable friction gear.

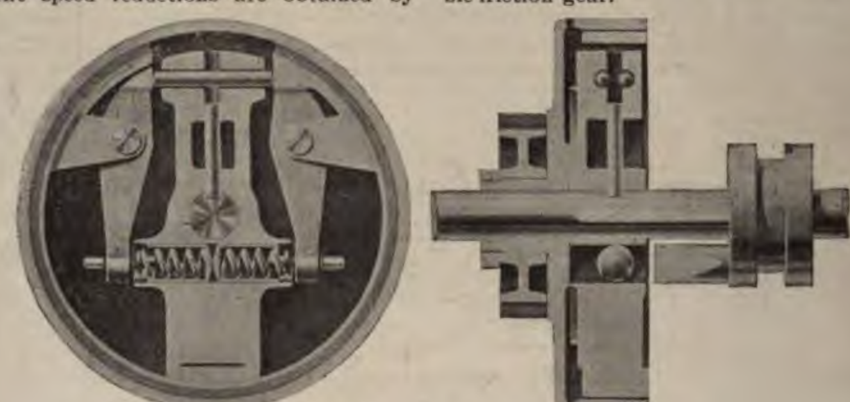

FIG. 5. FRICTION CLUTCH AND SPEED CHANGING GEAR.

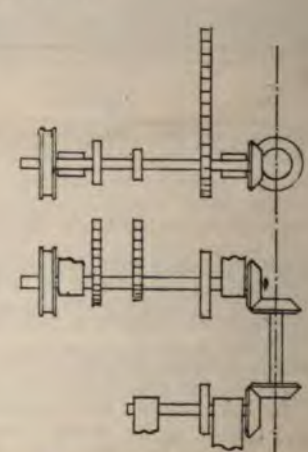

FIG. 8. PLAN AND ELEVATION OF GARDON TRANSMISSION GEARS.

The motor has two cranks, $m^2$ and $m^3$, Fig. 10, and these are connected by a double-arched connection piece $m^1$. The two cranks really have each three crank pins, the centre pins being acted on by the connection rods of the piston, and the other four, $b^1$, $b^2$ and $c^1$, $c^2$ being provided with rollers, and working on the inside of a system of cams of curvilinear, polygonal form (b and c). These cams, in the accompanying drawings and in the machine exhibited, are pentagonal. The two pentagons have a slight angular displacement relatively to each other, as seen in Fig. 11, and are keyed to a sleeve on the axle a. One revolution of the crank corresponds to ⅕ of a revolution of the pentagon, and the reduction is, therefore, in the ratio of 1.5.

To the sleeve on which the pentagons are keyed is fastened also one of two cupped discs of a friction transmission. Both of these discs, e and f, are loose on the hollow shaft d, but a sliding piece i, between them, is splined on it. When the engine is running the pentagons b and c are in motion, and consequently also the disc e. From e the motion is transmitted to f, by means of friction rollers, h and k, which can be swung around on fixed axes in their plane. When the plane of the friction rollers is parallel with the axle a, the motion is transmitted from e to f without any change in the angular velocity; but by swinging the rollers around in one way or the other, the ratio of speed reduction from engine to axle can be varied continuously and within wide limits. One side of the piece i forms a member of a friction clutch, and the other side a member of a positive clutch. In the illustration, the friction clutch is shown in gear, and this corresponds to the reverse or backward speed, the disc f now running free upon the shaft d. If f is clutched to d by means of the positive clutch, the motion of the vehicle is forward. The axle a is a split or differential shaft, the differential gear being seen to the left of Fig. 9. The steering spindles are hollow, and a short axle, running through them, fastens to the hubs of the wheels by means of a flange-bolted joint, as seen to the left of Fig. 9. These short shafts connect with the differential shaft a by means of universal joints. It may be stated here, although it cannot be seen in the drawings, that the throwing-in gear for all the forward speeds and the reverse speed is obtained by a single lever.

Fig. 7.—Gandon Steam Truck with All Wheels Driving.

The transmission of M. Gautier is patented in France, England, Germany and the United States, and he desires to dispose of his foreign patents.

Motor bicycles are shown at the Exposition in about a half a dozen styles, differing from each other, chiefly, in the disposition of the motor and the method of driving. There is first the

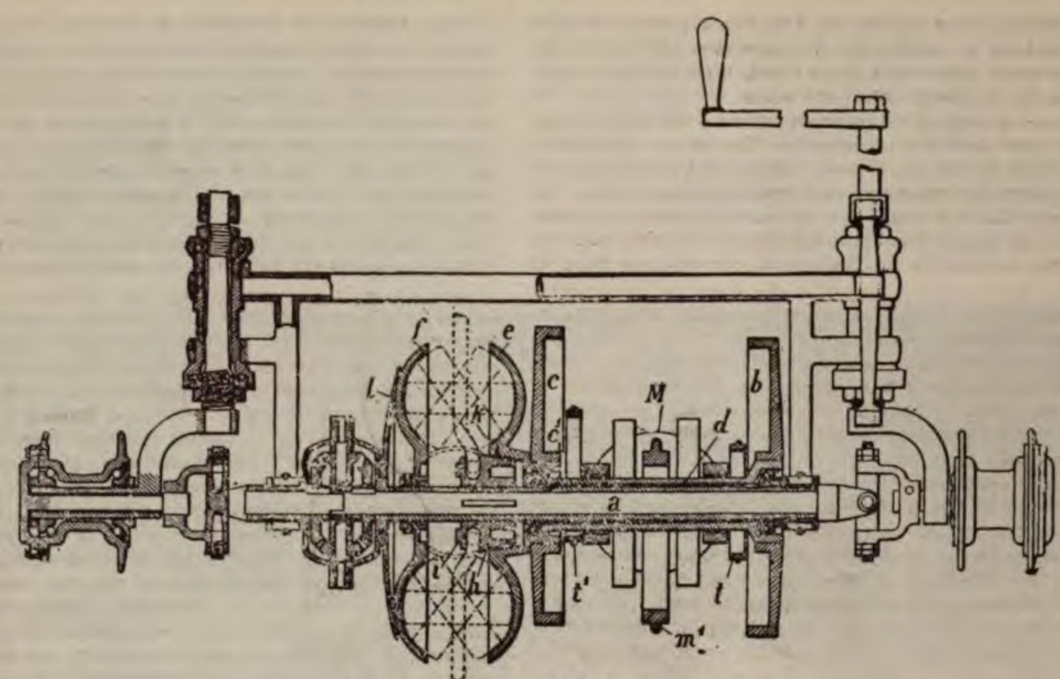


FIG. 9.—GAUTIER SPEED-CHANGING GEAR.

well-known Werner bicyclette, with its motor fastened to the front fork and belted to the front wheel; next the Chapelle and Chevallier bicycle, already described, in which the motor crank case takes the place ordinarily occupied by the crank hanger; thirdly, the motor bicycle of Lamaudiere & Labre, in which the motor is interposed in the braking tube of the diamond and belted to the rear wheel; fourthly, the motor wheel

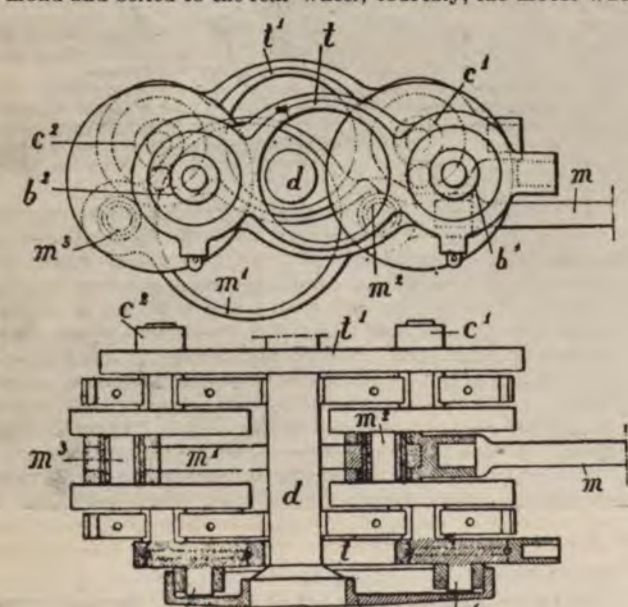


FIG. 10.—GAUTIER SPEED-CHANGING GEAR.

of Constantin & Cabannes, the motor of which is of the horizontal type, placed about centrally in the front trapezoid of the diamond frame, and chain belted to the rear wheel. In the German section at Vincennes is exhibited a motor bicycle, manufactured by the Werkstätte für Maschinenbau, vormals Ducommun, of Mulhouse in Elsass, and of which an illustration is herewith shown.

The motor is bolted to the front tube, and is connected by a crossed belt to the rear wheel. The motor is of 1¾ h. p., nominal capacity, and is geared down in the ratio of about 1.5. Ignition is either by hot tube or by the electric spark, the former being shown in the illustration. Both types are exhibited at Vincennes. The muffler is placed near the crank hanger, and the gasoline tank is suspended from the upper tube.

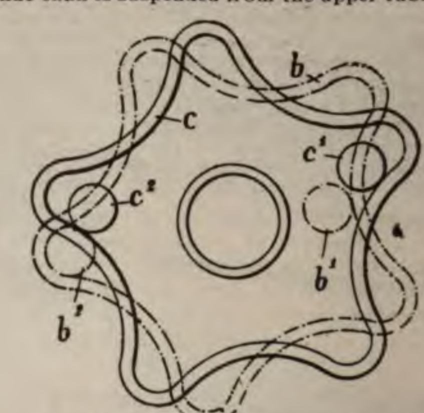


FIG. 11.—DETAIL OF POLYGONAL CAMS.

The weight of the machine complete is 92 pounds, and its speed, on the level, from 20 to 25 miles.

## PATENT LAW FOR THE OWNERS OF MOTOR VEHICLES.

BY JOHN C. HIGDON.

[NOTE.—In order to define the legal and mechanical status of the motor vehicle, and to inform investors and manufacturers as to just what may be patented and what may not be patented, we have concluded to publish the legal opinion of a well-known patent lawyer and mechanical expert, John C. Higdon, of Higdon & Longan, St Louis and Washington, D. C.—ED.]

DEFINITION OF A PATENT.

It may be well first to define a patent. A patent is a special privilege granted by the Government to an inventor, giving

him the exclusive control of his invention for a certain time, as an encouragement or reward for his ingenuity, and for the expense and labor to which he has been put in making his invention and placing the same before the public.

Furthermore, a patent is a contract between the Government on the one hand and the inventor on the other, whereby in consideration of his fully and freely disclosing his invention by means of complete drawings and specifications, so that in future (after his patent shall have expired) the public may freely make use of his invention—in consideration of this full and complete disclosure of an operative device, the Government grants unto the inventor a reward in the form of an exclusive right for the term of seventeen years only, after which the invention becomes public property.

It will thus be seen that patents are granted to inventors, not for their benefit solely, but principally for the purpose of benefiting the public. They, of course, encourage inventors to make inventions which may be useful to the public when placed at their disposal.

The patent is bestowed in case of something new and operative contributed by the patentee for the ultimate benefit of the public. If the invention was already known to the public, in common use, or if the patentee's drawing or specification is defective or incomplete, or if the device shown in the drawings be incapable of construction or useful work, the patentee renders no consideration for the privileges he obtains and fails to fulfill the vital condition of his contract, and his patent is illegal and void.

THE LAW UNDER WHICH PATENTS ARE GRANTED.

The Constitution of the United States has given Congress authority to enact suitable laws for securing to inventors for a limited time the exclusive right to their discoveries. (United States Constitution, Sec. 8.)

The Congressional Statute under which patents are granted for mechanical inventions is as follows:

"Sec. 4886: Any person who has invented or discovered any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement thereof, not known or used by others in this country before his invention or discovery thereof and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, or more than two years prior to his application, and not in public use or on sale for more than two years prior to his application, unless the same is proved to have been abandoned; may upon payment of the fees required by law, and other due proceedings had, obtain a patent therefor."

There are also statutes under which patents for designs or shapes are granted, but as design patents cover only the exterior of an article, and have no relation to the mechanical construction or function of machines, such patents will not be further referred to in this article.

FIG. 11.—DUCOMMUN MOTOR BICYCLE.

THE APPLICATION OF THE LAW TO THE MOTOR VEHICLE.

From the above presentation of the law, it will be seen that an improvement, in order to be patentable must not only be new and useful, but it must in law amount to what is termed *an invention*; in other words, a device must have required the exercise of the imagination or the inventive faculty. A thing may be so simple that it would readily occur to any skilled mechanic, and hence mere mechanical skill is not invention. Cunning workmanship is not invention; merely substituting iron for wood or one material for another will not support a patent, except the substitution involves a new construction, or develops new uses or properties of the article. To construct a device on a larger scale is not invention, but is a matter of degree only. Nor is an invention brought forward when two devices are aggregated instead of combined to produce a joint result. To illustrate, the aggregation of a washing machine placed upon a motor-vehicle will not amount to a patentable invention, even if the washing machine were driven by the motor of the vehicle. The reason for this is that a washing machine, although it be mounted upon a vehicle, produces only its usual result. Duplication of articles is not invention; the substitution of one device for another is not usually an invention, although if the substituted device be sufficiently different in construction and operation from that for which it is substituted, an invention will be produced. Hence, it is seen that a new combination without any new method of operation is not invention. It is not patentable to use an old device for a new purpose, except a new or improved result is thereby brought about.

THE SELDEN PATENT.

In this connection, it may be well to refer to the claims recently made by the owners of the Selden patent for a road engine, granted November 5, 1895, No. 549,160. Said patent purports to cover broadly all gasoline motor vehicles which use a compression engine and a friction clutch. The broadest claim of said patent is as follows:

Claim 1.—"The combination with a road-locomotive, provided with a suitable running gear, including a propelling wheel and steering mechanism, of a liquid hydrocarbon gas-engine of the compression type, comprising one or more power cylinders, a suitable liquid-fuel receptacle, a power shaft connected with and arranged to run faster than the propelling wheel, an intermediate clutch or disconnecting device, and a suitable carriage body adapted to the conveyance of persons or goods, substantially as described."

The drawing of this patent shows a common four-wheeled running gear, with a wagon body above it. Its front truck has a large fifth wheel, whereby the front axle and wheels may swivel on the wagon body, and the steering is accomplished by a rack and pinion. Its engine or motor is carried by the front truck and swivels therewith. The front wheels are used as drivers, in addition to their function of steering, and the power is transmitted to the said wheels by means of common gearing, with a clutch or disconnecting device, arranged to allow the engine to run without moving the vehicle. There are minor details of insufficient importance to be mentioned further.

It is clearly evident that the broad claim of the Selden patent should never have been granted by the Commissioner of Patents, inasmuch as it clearly appears that said broad claim involves nothing patentable. The reasons for this conclusion are as follows:

First: Its combination of the engine with the motor-vehicle and the friction clutch or disconnecting device did not amount to invention.

Second: It would readily have occurred to a skilled gas engine mechanic, and involved mere mechanical skill.

Third: It merely substituted one form of engine for another, inasmuch as the steam engine had been applied to motor vehicles fully fifty years prior to 1879, which latter was the year in which Selden applied for his patent. Furthermore, even a gas engine had been applied to drive a vehicle a number of

years prior to 1879, and a clutch was made use of all substantially in the manner shown by Selden, with the exception that the engine was not of the compression type. But it is clear that the mere substitution of one form of motor for another did not amount to invention.

Fourth: The engine shown in the Selden patent *is inoperative* for the reason that it has no flywheel, and this seems to be a very vital defect, inasmuch as it is common knowledge among manufacturers of gasoline engines that they will not operate without a fly-wheel unless the number of cylinders be greatly increased and their cranks arranged at various angles relative to each other.

We have already seen at the beginning of this article that a patent is a contract between the Government on the one hand and the inventor on the other, whereby, in consideration of him fully and freely disclosing a useful and *operative* invention, by means of complete drawings and specification, the public may freely make use of his invention after his patent expires. The Selden engine is inoperative for the reason above stated, and, therefore the inventor has failed to fulfill his contract with the Government, in so far as his broad claim is concerned; and, therefore, said claim is void and of no force or effect, and the public now have a perfect right to manufacture and sell motor-vehicles which have embodied in them a running gear, a wagon body, a gasoline engine, a friction clutch, suitable gearing for connecting the engine to the driving wheels, and any suitable steering mechanism upon which the patent (if any) has expired.

The Patent Office has in the past issued various patents by mistake, and which have been declared null and void by the courts for various reasons. To illustrate this point, the courts have held that an invention is not involved in mounting an ore stamp-mill on rollers, so as to easily move the mill about when desired. (Hendy v. Golden State and Miners Iron Work, U. S. Supreme Court, 88; 127 U. S., 370.)

It is not invention to apply, by an old mechanical arrangement of shafts and cog-wheels, the power of an engine on a boat, to rotate a capstan instead of rotating a windlass on land, as had previously been done. (Morris v. McMillin, 1884, 112 U. S., 244.)

It does not require invention to apply to a fulling machine an old shifting device. (Royer v. Roth, 1889, 132 U. S., 201.)

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A steam road service has just been established between Novara, Italy, and Robbia. Similar services between other small towns in the district are contemplated.

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*The Mechanic*, which has been published for 30 years past by the H. B. Smith Machine Co., has been sold by them to the Smithville Publishing Co., owing to the pressure of business having become so great that the former company could not afford the time required to continue the publication. The first number of Vol. I, under the new management, has reached us, and is a neat and creditable piece of book-making. It is intended as a review of all publications of interest to wood workers.

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## SOME EXACTING TESTS.

Governor Shaw, of Iowa, has ordered a $1,500 motor carriage of the Chicago Motor Vehicle Co. A Des Moines paper thus reports the tests which preceded the placing of the order:

For the benefit of the Governor, the factory hands placed a block of wood a foot square close to the hind wheel of the automobile, then started the engines slowly. The vehicle mounted the obstruction easily, and crossing it, passed down on the other side without a jar. An egg was placed beside the lock, and the throttle once more opened. The vehicle passed over the lock, and the wheel was lowered to a point where the shell of the egg was cracked, and without touching the floor, the wheel was again raised and made to assume the position from which it started. At the conclusion of these experiments, the Governor ordered a carriage built.

# ...COMMUNICATIONS...

## A DELIGHTFUL TRIP IN AN AUTOMOBILE.

ITHACA, N. Y., July 27.

*Editor* HORSELESS AGE:

At 1 p. m., Saturday, June 16, the Hon. E. C. Stewart and myself in my Winton motor carriage started from Ithaca on a journey East. We were accompanied by Samuel Howe, of Cornell University, and his friend, S. M. Vauclain, Jr., in the former's Winton carriage.

Our first stop was at Cortland, 22 miles distant, which we reached in an hour and a half. We found the roads in fair condition, but passed through a very hilly country, some of the grades taxing our autos to their utmost. At Cortland we stopped to oil our machines, and put in a fresh supply of water.

Between Cortland and Truxton, we met with our only mishap on the trip. As we rounded a curve about three miles this side of Truxton, we came in sight of a carriage containing a woman and child about one-eighth of a mile distant. The woman became very much excited and rattled at our appearance, and reined the old family horse around in great haste, spilling herself and grandchild into the ditch. The top of the buggy struck the fence and rebounded back on to its wheels, allowing the old horse to jog away down the road out of sight. The ditch being about three feet deep, the sudden disappearance of the woman and child made our hearts palpitate in a rather unpleasant manner. On riding up, we were greatly relieved to find that they were not seriously injured. After gathering up the lady's effects, I took her into the auto beside me, and the Senator was pleased to play footman for a mile or so. Mr. Howe, who was about a mile in the rear at the time of the mishap, came up and took charge of the girl, and we proceeded on our journey. At a farm house, about two miles below, we found the family horse and buggy in possession of the owner of the place, and on our nearer approach the horse showed no fear of the machines, which convinced us that the woman was at fault for the accident rather than the horse. We found that she was some five miles from her brother's, whom she was on the way to visit, and as she was somewhat nervous from the shaking-up, we suggested that they remain at Truxton over night, and continue the journey the next day. We employed Mr. Farmer to drive the horse to the hotel at Truxton, and we delivered our passengers at the same destination. After expressing our regrets for the accident, and settling for their entertainment until morning, we continued our journey to DeRuyter, some ten miles away, where we took supper. At this point Senator Stewart returned to Ithaca, and my son Edward, who had come up by train, joined us. We pushed on to Cazenovia, 17 miles away, to spend the night, making a run of 60 miles in about five and one-half hours, which we thought very good, taking into consideration the condition of the roads and the hilly country we passed through.

At 9 o'clock the next morning we left Cazenovia for Richfield Springs, passing over some of the poorest roads encountered on our journey. The farmers, unfortunately for us, had been working them, plowing as they do along the ditches and throwing the sods into the middle of the road; and it was bump, bump, bump from 9 a. m. until 3:30 p. m., and both Mr. Howe and myself were relieved to reach Richfield Springs without any break-down. This is what is called the old Cherry Valley, turnpike, and in taking this road instead of going from Cazenovia north to Syracuse, and so on down the Mohawk Valley we expected to save about twenty miles. You can rest

assured that after that day's experience we made up our minds that we would give the Cherry Valley turnpike a wide berth in the future. After tea we consulted our maps and decided to leave this route and go to Fort Plain, and so on down the Mohawk Valley to Albany. We had a refreshing night's sleep, arose early, gave our machines a thorough overhauling and cleaning, breakfasted at 6:30, and left Richfield Springs at 7:30 for Fort Plain. We had a delightful run through a wild country, over good roads, to Fort Plain. From that place we continued our way down the valley of the Mohawk through Herkimer, Little Falls, St. Johnsville, Fonda and Schenectady, arriving at Albany about 5 o'clock in the afternoon. From Fort Plain to Schenectady we found very good roads, beautiful farms and fine scenery. It was very amusing to have the New York Central trains go by us, the enginers saluting us with three whistles. At times we would come up with freight trains, and where the roads were good could hold our own with them. In places I think we traveled at the rate of eighteen or twenty miles per hour. From Schenectady to Albany, 17 miles, we followed the old turnpike road, which was in very bad condition, the same being in places from six to eight inches deep, which necessitated slow progress. In Albany we found very good accommodations at the Hotel Ten Eyck. Mr. Howe and friend having decided to remain in Albany for a day or two, we left their genial company Wednesday a. m. at 20 minutes to 5, and made a good run to Hudson, 40 miles by the route we took, in two and one-half hours. At Hudson we stopped for breakfast and sat down to a meal fit for the gods, with appetites whipped to a keen edge by that delightful ride in the exhilarating air through the foot-hills of the Catskills.

Leaving Hudson at 9 a. m., we passed through the pretty villages of Burden, Manorton, Red Hook, Rhinebeck, Staatsburg and Hyde Park to Poughkeepsie, over what I believe to be the ideal roads of America for automobiling. Some of our fastest time was made over these roads, and at times we attained the speed of 22 miles per hour for short distances. The run from Hudson to Poughkeepsie was made in 2 hours and 50 minutes; distance registered on our cyclometer 43 miles. The views of the Catskills from the east side of the Hudson are superb and long to be remembered. After an hour and a half rest, proper attention to the inner man and a good feed of oil to the iron horse, we left Poughkeepsie, passing through Fishkill, climbing the mountains between Garrison and Peekskill in good shape, and arriving at Sing Sing at 5 p. m., making a day's run of 125 miles. After stopping over a day with friends at Sing Sing, we made the run of 17 miles to Greenwich, Conn., by way of Tarrytown, White Plains and Port Chester, in an hour and a quarter.

Our return was over the same route to Albany, from Albany to Saratoga Springs, Saratoga Springs to Amsterdam, and so up the Mohawk Valley to Syracuse, and from there to Ithaca. Distance covered, 450 miles from Greenwich. This ended one of the most delightful trips it has ever been my pleasure to take.

GEO. F. FOOTE.

## A SUGGESTION TO THE OWNERS OF SMALLER SIZE D DION MOTORS.

The de Dion-Bouton Motorette Company, of 37th street and Church Lane, Brooklyn, N. Y, manufacturers of the de Dion-Bouton motors, under license from the de Dion-Bouton Company of France, tell us they have in stock quite a number of parts for changing over any of the small size ($1\frac{3}{4}$ h. p.) air-cooled motors to $2\frac{1}{4}$ h. p.

All that is necessary is a new cylinder, piston and cylinder head with valves.

This exchange is made by the de Dion-Bouton Motorette Company at a very moderate price, and any who have tricycles or quadricles with these small motors would do well to communicate with the Motorette Company, and try to arrange to get the parts to enlarge their motors, as the results they could get out of their machines would be much more satisfactory to them in the service they would get, also in the ability to mount steeper grades than they could heretofore climb.

# ...OUR... FOREIGN EXCHANGES

## THE MOTOR VEHICLE CONGRESS IN PARIS.

Builders of mechanically-propelled road carriages are so much in the habit of making exaggerated claims for their vehicles, which are rarely, if ever, warranted by actual experience, that those outside the industry may have some reason for expressing doubt as to whether the motor car in its present stage is capable of giving entire satisfaction. Despite the accumulated experience of makers and users, and the trials and experiments which have been carried out during the past five or six years there is still very little known about the theory of the motor car. As the industry is a new one, and has given rise to entirely new problems, progress has necessarily been extremely slow, but it was supposed to have now reached a point when makers would at least find themselves no longer groping in experimental darkness, and would have been able to lay down definite rules for guidance in the manufacture of mechanical carriages. It was hoped that the first international congress held in Paris last week would have reported satisfactorily upon the condition of the motor car, and have given some indication of the lines on which it would undergo a rapid development in the future. Unfortunately, these expectations are far from being ustified. At the inaugural meeting in the Palais de Congrès, the President, M. G. Forestier, confessed that an inspection of the motor cars in the Exhibition showed him that the Congress would have plenty of work to do in order to put makers in the right way of turning out satisfactory vehicles. He evidently believed that wisdom lay in the multitude of councillors, but when the members of the Congress began to tackle the various questions submitted to them, they found that they knew less about the matter than the makers themselves. M. Forestier touched the spot when he said that the ideal motor car must be simple and cheap, and all the parts made to template, so that when the tourist was on the road he would be sure of finding exchange parts at the nearest bicycle or motor car agency. At present every motor car is made up of patented parts, and builders seek to render their respective vehicles as exclusive as possible. If the mechanical carriage is to become popular, all these patent devices must give way to a simple motor and simple transmission gear, but it is to be feared that, while manufacturers try to protect themselves with patents, we shall have to wait a long while for a car embodying all the elements of simplicity.

As the Congress only held five sittings, it was impossible to discuss fully all the questions submitted, but nevertheless a considerable amount of work was got through, though we do not think that, on the whole, it is likely to be of much profit to the industry. The program was divided into five sections as follows:—Steam, internal combustion and other motors; electric motors; power-transmission gears, underframes, and carriage work; axles, wheels, and tires, and tractive effort; historical, economical, and international questions. Each subject was introduced by one or more reports by experts, and a curious thing about them was the refusal of the authors to commit themselves to any definite opinions. The various problems were merely touched upon, with an expression of regret that no trustworthy data were available to allow of their arriving at a definite conclusion. This, indeed, sums up the whole work of the Congress. The result must be held as rather discouraging, in view of the large number of trials that have been carried out with all classes of motors and mechanical vehicles, and the problems are, indeed, so complex, and have to be regarded from so many different standpoints, that it is extremely difficult to arrive at a satisfactory conclusion. The only part upon which the Con-

gress was prepared to commit itself was the restricted employment of steam generators for motor cars. After M. Amedée Bollée had read his report on steam boilers, the Secretary, Comte de Chasseloup Laubat, presented a motion in favor of recommending motor-car builders to employ water-tube boilers for heavy steam cars, and internal combustion engines for light vehicles, by which it was implied that steam was not suitable for small vehicles. This motion was strenuously opposed by Major Howard, one of the American delegates, who said that 2,000 light steam cars were running in the United States, and were giving satisfactory results, while he had just tried a new French steam carriage, which was even superior to those built across the Atlantic. The Congress was at length induced to accept Major Howard's amendment, which simply recommended the carrying out of an investigation into the respective merits of water and fire-tube boilers; but they carried another motion, in spite of the American delegate's protest, condemning the employment of spirit or other liquid fuel for firing steam boilers, which, by mixing with air at the ordinary temperature, would be liable to cause accidents. There was no discussion whatever upon steam cars, and there could be no illusion as to the opinion of the majority of the Congress upon this form of motive power, for all the attempts which have been made in France to organize public services of steam cars have failed, with scarcely an exception, though they are being successfully used by the military authorities, with whom the question of cost is not, cf course, an important matter. The difficulty lies in carrying a big enough load to make the venture pay, since in districts which are not served by the railways, the traffic is usually very restricted. Amedée Bollée, who built the first steam car in France, a quarter of a century ago, said that his experience had been that a steam car selling at 14,000f. cost about 15,000f. for repairs, and at the end of five years it was only fit for the scrapheap.

This was not the only illusion which was dispelled at the Congress, for during the discussion upon electric motors, details were given as to the results of the trials of accumulators carried out by the Automobile Club de France last year. These reports were altogether disappointing. Only one of the batteries was said to have given anything like good results, and all the others entirely failed to fulfil the conditions of the trials. Count Kalowrat said that the foreign delegates were greatly disappointed, since the trials did not tell them what they wanted to know—that is to say, what was the lightest battery in relation to the capacity. The discussion was carried on almost entirely by the foreign delegates, who urged that a distinction should be made between heavy and light batteries—that is to say, those weighing 100 kilos. and 80 kilos, respectively—and that each should be submitted to a different *régime* of discharge, as it was obviously unfair to test the lighter batteries under the same conditions as the heavy. It was decided that in future trials this should be done. The discussion then turned upon the advisability of employing heavy batteries with greater durability for town vehicles and light batteries for touring cars, and a recommendation in favor of this distinction was adopted. On the whole, however, it was evident that the Congress was not satisfied with the adaptability of the existing types of accumulators for road carriages, and it did not seem to look forward with much confidence to the carrying out of improvements which would increase their capacity and durability. With regard to transmissions, underframes, and carriage work, there was nothing new, with the exception of a pneumatic transmission, described by H. Crouan, which is of very ingenious construction. For each speed he has two spur wheels in contact, one of them running loose, and this loose wheel is placed between two discs, one of which is fixed and the other moves on the shaft longitudinally. The latter disc is separated from another by a space of about half a millimetre, containing a leather disclet into a grooved face. Above one of the combustion chambers of the motor is a valve admitting the gases into a small receptacle, which communicates with the hollow shaft carrying the discs and loose wheel. With each explosion in the motor, gas enters the receptacle until it is at the same pressure as in the cylinder, and when this equilibrium is established no more gas can enter. To operate the gear, the compressed gas in the receptacle is admitted into the hollow shaft and presses the leather disc outwards against the disc, with a horizontal movement, which in its turn presses against the loose wheel, with the result that it becomes fixed. A separate arrangement is needed for each speed. This, of course, complicates the mechanism, but it has the advantage of changing the speed without any shocks or jarring, and owing to the considerable pressure brought to bear upon the loose spur wheels, its action is said to be instantaneous and unfailing.

The difficulty of getting trustworthy data with respect to the working cost of motor cars, was seen in the report presented by M. Perissé, who went to every possible source of information; but while some makers refused to tell him what he wanted, others gave information in so many different ways that the results could only be arrived at more or less approximately. He concluded, however, that a service of steam cars ought to be worked at a profit, but M. Forestier, who has conducted all the heavy car trials held in France, said that the figures were too optimistic, and that they could not get over the fact that the steam car would never be so economical as the draught horse, which was capable of doing 5,000 times its weight in work in the course of a day. This expression of opinion was another surprise for a good many members of the Congress, who were under the impression that the steam car was going to suppress the horse for draught purposes. In speaking of steam cars, M. Forestier alluded chiefly to the types of vehicles constructed in France for carrying a load of one or two tons. Some interesting data were also afforded in the reports and discussions upon the tractive and other efforts to which motor cars are subjected, but here again, there was a very wide diversity of opinion; for while some condemned ball and roller bearings for the heavier cars, others favored them, though, on the whole, it was held that experiments had shown that for heavy cars there was little advantage to be gained by using ball or roller bearings on the wheels. The difficulty lay chiefly in keeping a perfect alignment of the bearings when supporting a heavy load, and when the bearings were at fault, they not only lost their efficiency, but were a source of serious danger. Another interesting question was raised by M. Forestier, who said that there was a disadvantage in using very broad tires on motor cars. Broad tires had the advantage of reducing resistance, due to compression on the road, but this advantage was lost through the friction of the outsides of the tire when turning. It was therefore desirable to employ tires of moderate width. The Congress concluded its sittings by making a series of recommendations, which would be reported upon and discussed at a future congress. The Paris Committee was charged with the task of preparing these reports, and fixing the date of the next meeting.—*The Engineer.*

## MOTOR VEHICLE FATALITY.

Much excitement was caused at Kenilworth on Monday by a motor-car accident which, unhappily, terminated fatally. It appears that Harris Ely, of Ulverstone, the consulting engineer to the North Lonsdale Cycle Company and district inspector for the National Telephone Company, had purchased a motor-car from Allard & Co., on the previous Saturday. He started on Monday for his first tour, intending to go to Bristol. He got along at a fair speed until at Kenilworth his car suddenly stopped dead for an instant, rose upon its front wheels, and overturned forwards, dashing the unfortunate gentleman with great force to the ground. His companion immediately rushed to Mr. Ely's assistance, as did several people who were in the vicinity, and heard the hissing noise of the overturned car; but they found that he was lying dead, with the fore part of his

head crushed in. When the police righted the car, to take that along as well, they found, it is stated, that a pin was missing from the steering gear actuating one of the front wheels of the car, which had, apparently, turned broadside on, and stopped the car dead, with the result, of course, that it instantly capsized. The missing pin, it is further stated, was found lying in he road near a cottage a little way further up the hill.

At the inquest held on Tuesday, James Montgomery, Allard and Co.'s works' manager, said he was riding on a motor-cycle in company with the deceased on the car, on the morning of the accident. He had since examined the car, and believed the deceased had put the low-speed belt on the motor in descending the hill, which would have a checking effect upon the car. There was also a pin missing from a joint on the rod, which connects the two steering wheels. Either of those matters would cause the accident, and witness could not say which. The witness explained to the jury that the low-speed belt, if put on, would act as a brake on the car, and check it to about five miles an hour, no matter how steep the hill was. He said he was convinced that this was the cause of the accident until he saw the pin. He was of opinion that the deceased had been running down the hill with both belts off, and at the time of the accident had put the slow belt on. He thought it was probable that the pin which came out had had several severe wrenches on Sunday, when the deceased was trying the car, and swerved the steering of it several times violently, and once ran into the bank in trying to turn it round. The deceased had overhauled the car on the morning when he started, and witness considered it possible that he had loosened the pin in doing so. It was possible that it might work loose, like all nuts and bolts. Mr. Valentine, consulting engineer, who said he had owned and driven motor-cars, gave it as his opinion that the loss of the pin and the freeing of the wheel caused the same to turn outwards and lock, with the result that the steering bar went among the spokes and the car overturned, the whole weight of the machinery being in front. The jury found that death was due to a fracture of the skull, produced by the overturning of the car, which the loss of the pin from the steering gear caused.—*The Motor-Car Journal.*

A French railway engineer recently returned from the Paris Exposition to Tunis, where he introduced the first automobile ever seen in that corner of Africa. During the last years the French have built more than four hundred miles of macadamized roads in Tunis, and many new roads are in course of construction. Therefore, the roads are favorable to the automobile sport. Hundreds of natives followed the automobile when it passed through the streets of Tunis.

## THE BLAKE RADIATOR.

On page 18 of The Horseless Age for May 16 last was mentioned a unique water radiator made by F. C. Blake, of Ravenscourt Works, Hammersmith, Eng. We show herewith an illustration of a section of this radiator. It is made entirely of copper, in the form of a tube, with six wire gauze pipes soldered to its circumference.

The Blake Radiator.

## TRACTION ENGINES VS. MOTOR WAGONS IN ENGLAND.

The majority of traction engines that have survived opposition and attack have done so largely because they have been employed on a class of work that it is almost impossible to get done any other way. Apart from agricultural uses, which are outside the scope of our inquiry, their application is to the transporting of boilers and other extraordinary traffic, or to the touring caravans of showmen, more than to the handling of general merchandise. In fact, it may safely be asserted that only a fraction of one per cent. of the great volume of traffic in Lancashire is at the present time touched by mechanical power on common roads. This failure on the part of the so-called "steam horse" to benefit trade by improving and cheapening communication is sometimes used as an a priori argument against the modern motor wagon. An inquiry into the differences between the two systems is essential to a fair conception of the possibilities of road transport under the 1896 "Light Locomotives" Act.

The chief reason for the failure of the traction engine is that it labors under adverse legislation, which allows County Councils and certain other local authorities to make repressive by-laws. Even the most recent Act affecting traction engines, which was passed less than two years ago, retains, among others, clauses having the following significance:

(a) Minimum of three men in attendance.

(b) Speed not to exceed four miles per hour in the country, nor half this in towns.

(c) Open field for local by-laws upon bridges, highways, and times of working.

Why such regulations? They are the sequelæ to a deep-rooted aversion to the appearance, dimensions, weight, noise, vibration, smoke, and smell of the early traction engines. The presence of these ungainly "old crocks" upon our roads to-day is deplored by other owners and users of traction engines, but in coming to any decision on the matter we must deal with things as we find them. Most modern traction engines are free from many of the reproaches that attach to those which date back a dozen years or more. Moving parts are cased, the general design is improved, the noise of the exhaust is reduced by compounding, firing and blowing-off are under better control, and spring mounting has been adopted with promising results. Still one is compelled to admit that the traction engine is unpopular, and even hated both in town and country, and the outcome of this old prejudice is that the user to-day has to face the hard logic of local by-laws, which practically throttle any scheme for the conveyance of ordinary merchandise, at popular rates, over distances of, say, thirty to forty miles. For instance, two adjacent authorities can, by adjusted time regulations, bar absolutely the passage of traction engines between points exterior to their own areas.

Let us suppose, however, that the difficulties of obtaining a clear way can be surmounted, and that a traction engine hauling three trucks can be run thirty or forty miles on the highway without molestation or harassing espionage. The point then to be determined is whether the use of such a road train is the most economical method of conducting the transport of general merchandise. It might be, if simple conveyance between two points meant the completion of the service. But the loads must be collected at one end and delivered at the other, and this necessitates the horsing of the component wagons for distances of several miles. In Manchester, for example, traction engines may not travel between the hours of 9 a. m. and 5 p. m., which introduces a serious terminal difficulty, and one which vitiates the economy of haulage from Liverpool by at least 0.5d per ton mile. It is too much to assume that these legal drawbacks can be overcome except at great expense, and to attempt a regular service of traction engines under the Locomotives' Acts of 1861, 1865, 1878, and 1898 would be to accept risks sufficient to add a good many pence per ton mile to the costs of working.

Turning now to the proposals for road haulage by motor wagon under the 1896 Act, a more promising state of affairs exists. Whatever structural improvements have been effected in traction engine practice, the motor wagon possesses them in a greater degree, with the added advantages of smaller weight and neater design upon lorry lines. But the vital difference in favor of the motor wagon is its complete exemption from local interference, the roads of England being continuously open to it under one set of regulations, and no licenses are required for vehicles used exclusively for goods' haulage. Pedantic opposition is impossible, since local bodies have no power to make restrictive by-laws. The Local Government Board may, on the application of any local authority, issue special regulations for the district in question, but the onus of proof is upon the local authority, and not upon the user of the motor wagon—the reverse of what is law in respect of the traction engine, which can be proscribed at will. The choice between the traction engine and the motor wagon is a choice between a system open to attack from many quarters and a system not only legally free, but unopposed, if not approved, by popular sentiment.

In conversation with a prominent railway engineer last week upon the prospects of heavy motor traffic, I heard some interesting criticisms. His two principal comments were—(a) that commercial success was impossible on common roads, where the rolling resistance is six or eight times that of the railway; and (b) that to attach power and labor to each seven-ton unit must be inferior in economy to the traction engine. The reply will be found in my notes which appeared on the 3d instant, for the elimination of terminal more than compensates for the heavier outlay in the directions named in (a) and (b). As regards the traction engine, I have dealt with it above. A seven-ton unit may account for higher power and labor charges per ton, but its mobility is all-important. Both arguments against the motor wagon must yield to the two years' experience of Messrs. Fuller. A business man does not concern himself with ratios of frictional resistances, or the incidence of power and labor charges. If you carry his goods below the railway rates, he will give you his traffic.—*Liverpool Journal of Commerce.*

## AN ACCIDENT AT TOURS.

On Friday last, a most regrettable automobile accident occurred in the neighborhood of Tours, whereby two of the four occupants of the car lost their lives, and a third sustained serious injuries. The mishap took place at an early hour in the morning on the Amboise road, which, at the scene of the accident, runs by the side of the river Loire. M. Vandevelde, a Belgian engineer, accompanied by his wife and a fellow-countryman, M. le Comte de Thuidzeyle, were traveling in the direction of Tours, when suddenly one of the front wheels of the car struck a large block of stone, which had become detached from the parapet bordering the river, and lay in the roadway. The vehicle, not being fitted with irreversible steering gear, swerved violently and struck the parapet with great force, against the massive stones of which the passengers were thrown. The passers-by at once ran to the unfortunate traveler's assistance, only to find that monsieur and madame had been killed instantaneously. M. de Thuidzeyle, although badly contused, and also burnt by the petrol, which escaped from the broken reservoir and was fired by the burners, is not in any danger, and will doubtless have quite recovered in a few days. M. Vandevelde's servant, who was also in the car, fortunately escaped with only a few bruises, as his fall was broken by the awning of the vehicle. The terrible accident once again emphasizes the importance of fitting every vehicle with an irreversible steering gear, and constructors will do well to study this question with the greatest attention.—*The Motor-Car Journal.*

The Shah of Persia has ordered a Gardner-Serpollet steam carriage for his personal use.

## THE FRENCH AUTOMOBILE CLUB'S FÊTES.

As I stated some time ago in these columns, the dates originally selected for the two fêtes given by the Automobile Club of France, in honor of the Commissioners of the Exhibition, were July 18th and 19th, but by reason of the former date clashing with the visit of the Commissioners to the naval manœuvres at Cherbourg, it was found necessary to make a change, and the fêtes therefore actually took place on Thursday, the 19th, and Saturday the 21st instant. These festivities were the more noteworthy on account of the new theatre being utilized for the first time. With a seating accommodation for 800 persons, this beautiful *salle* is the most remarkable of all the magnificent rooms in the club house. It is situated on the first floor, and directly above the *garage*, access to it being by way of the members' dining room, or by a new staircase, which mounts from the courtyard. The theatre consists of a ground floor and a balcony, the seats in every part of the house being of the most luxurious character, and upholstered in yellow leather. The walls and ceilings are of a snowy whiteness, and carry a number of bas-reliefs, dealing with automobilism. The drop curtain is of yellow velvet, and handsome curtains of the same material decorate the various entrances. Handsome as the *salle* is in the daytime, the effect by night is really wonderful, for the electric light installation is the work of an artist. Hidden away behind two cornices, the one actually in the ceiling and the other almost at the top of the walls, are two rows of lights running entirely round the hall, giving a marvelously subdued light, and one changed at will from a warm, rich rose to a golden yellow. Large arc lamps are placed against the walls, while around the underside of the balcony are arranged a number of dark-colored lights, which give a wonderfully pretty effect to the appearance of the theatre.

On Thursday evening, this installation was not seen to advantage, for almost immediately after the numerous company had been admitted into the hall the light failed entirely, and it was only by very occasional fits and starts that it made its reappearance. As the visitors had been previously warned of such a possibility, no panic or undue excitement occurred, and everybody waited patiently for further developments. These came in the shape of an assorted collection of candles, lamps, and lanters, gathered together from every part of the club house, and by their united efforts sufficient light was thrown upon the stage to permit of the program being proceeded with. By way of lime lights, three large acetylene lamps, borrowed from cars in the *garage*, were utilized, and the sight of certain well-known club men, manipulating these miniature lighthouses from the balcony, will not readily be forgotten. This *contretemps* was undoubtedly very annoying to the organizers of the fête, but it amused the audience vastly, and but few left the theatre until the curtain went down on the last number of the program at 2 o'clock in the morning. The light on Saturday evening behaved itself, however, and the visitors were treated to a delightful soirée.

Rejoicing in bright and tuneful music and several witty songs, the review scored a great success, M. Lépine, who was himself present, being especially amused by the humorous caricature of his creation—the cyclist-policeman. In addition to the principal members of the Club and nearly all of the Commissioners of the Exhibition, there were also present the Maharajah of Kapurthala, Prince della Rocca, Comtesse Cahen d'Anvers, Baronne de Bélinay, Comtesse A. de Golstein, Comtesse Cognard, Vicomtesse A. de Contades, Marquis de Gouvello Comte de Nion, and many other visitors too numerous to mention.—*The Motor-Car Journal.*

The President of the Bordeaux Automobile Club has been asked by the local authorities to appoint a committee to draw up regulations for cycle and motor-car traffic in the Bordeaux district.

## A NEW SELF-HARDENING STEEL.

The Bethlehem Steel Co. has for some time been at work developing a new process for treating tool steels, with a view to increasing the output of their machine shops. Although their work in this direction was first undertaken for their own benefit only, yet the results obtained have been so noteworthy as to encourage them to put their new process on the market for the benefit of machine shops generally. They have given us the following particulars of the results obtained, which our machinist readers will recognize to be remarkable:

THE TAYLOR-WHITE PROCESS OF TREATING TOOL STEEL.

F. W. Taylor, in the reorganization of our shop methods, found several changes necessary, the most important of which was the discontinuance of the miscellaneous assortment of tool steels used by the different men in the shop, and the establishment of a standard and uniform grade of tool steel, the use of which would be enforced upon all of the men regardless of their preferences.

A special lathe was set aside for the purpose of experimenting with tool steels of different makes, with a view to the selection of a standard for use, and several picked men were set to work testing the relative merits, not only of the different tool steels then in the shop, but of all brands of established reputation. In the elaboration of these tests the services of our Engineer of Tests, Maunsel White, were enlisted.

This full and exhaustive investigation led up to the discovery which, carefully studied and persistently followed up, step by step, has resulted in the remarkable development which can be seen in our machine shop at the present time.

In the tests of these various makes of tool steels over 200 tons of steel forgings have been cut up into turnings on the experimental lathe, and it is estimated that over $100,000 has been expended in labor and material alone in developing the process called by the names of the discoverers, the "Taylor-White" process. A still further large sum has been invested in the patents covering the process, which have been purchased by the Bethlehem Steel Co. from the inventors.

This large investment, however, has more than been repaid in the last year, by the saving in labor, cost and larger output. The increase in cutting speed of the various machine tools throughout the machine shop has entirely reversed the inequality of balance existing two years ago, so that the capacity of the forge has had to be largely increased to keep pace with the rapidly growing efficiency of the machine shop.

The introduction of this process for the treatment of our tools has enabled us to speed up our main lines of shaft from 90 to 250 revolutions, and further changes in countershafts have been made to speed up individual machines, which has brought about the largely increased efficiency in our machine shop.

In order that the rate of progress might be observed, records rom time to time were made of the average amount of metal cut per hour per tool throughout the shop. The table shows the increase in efficiency made up to January of this year.

| AVERAGE | Oct 25, 1898. | May 11, 1899. | Jan. 15, 1900. | Gain in % cut of 3d over 2d. | Gain in % cut of 3d over 1st. |
|---|---|---|---|---|---|
| Cutting speed | 8'-11" | 21'-9" | 25'-3" | 16% | 183% |
| Depth of cut | .23" | .278" | .30" | 8% | 30% |
| Feed | .07" | .0657" | .087" | 32% | 24% |
| Pounds of metal removed per hour | 31.18 | 81.52 | 137.3 | 68% | 340% |

The virtue of the "Taylor-White" process, which we are using for the treatment of our tools, is that it gives to the steel the very valuable and exceptional property of retaining a high degree of hardness when heated to a visible red heat. It is possible with one of these tools to cut steel at a speed so great as to heat up the point of the tool to redness, and have it continue to cut for several minutes at this speed, leaving an unusually smooth finish on the work, as well as cutting accurately to size. The advantage in leaving a smooth roughing cut, and of having the work accurately to size, will be readily appreciated, as it materially lessens the work of finishing.

The practical speeds at which these tools will run has been found to be from two to four times that of any steels which we have experimented with, and we have endeavored to obtain the best in the market.

The effect of the "Taylor-White" process, which is applied after the tool has been dressed or machined to shape, penetrates to the center of the steel, even in the largest tools we have ever treated, *i. e.*, four inches square.

Although all of the standard brands of self-hardening steel, which have been experimented with, are improved to a more or less extent by the treatment, it is preferred to use a steel of special composition, in order to get the greatest uniformity and maximum results.

This special steel forges so much more readily than the general run of self-hardening steels, that tools of difficult shapes may be easily made up.

We have also discovered a simple and comparatively rapid method of annealing our special steel, by which tools may be easily machined to shape, making it applicable to twist drills, chasers, inserted cutters, etc., which have heretofore not been made from self-hardening steel.

A very important feature resulting from the use of this process is that the tools are extremely uniform in quality, so that work on which they are used can be regularly performed at the maximum rate of speed. The variation in the quality of these tools does not run over 5 per cent., which insures a much greater degree of uniformity than is attained in any other tool that we know of, whether made either of tempered or any air-hardening steel. With uniform tools, the piecework system can be most efficiently used, as the piece rate must always be based, not on the average cutting speed of the tools, but on the speed of the worst tool in use.

A great advantage in the use of these tools is, that when cutting dry, at the rate of maximum efficiency, the chips should come off blue. These blue chips enable a foreman at a glance to tell whether the work is being done at the proper speed. When running under water, at the proper cutting speed, the chips should show blue immediately upon shutting off the water, and allowing the tool to cut dry for a few moments.

The apparatus used in the "Taylor-White" process offers also a simple and effective means of heating any other tools at uniform temperatures, which can be easily controlled, so that ordinary carbon steels can be hardened through the use of the same apparatus at temperatures which will insure greater uniformity and higher qualities in this class of steel, as well as in self hardening steels.

As is well known, tempering steels of different makes and different qualities require different temperatures for hardening to obtain the best results, therefore by means of our apparatus, which is capable of closely controlling temperature, these points may be accurately determined for each class of steel, and made use of in daily practice.

The operation of the process is extremely simple, as it is controlled by apparatus which regulates the different steps, and does not require skilled or expert labor.

We have been glad to undertake in our shop any experiment desired, in order to satisfy interested parties of the value of our treated tools. We have an experimental lathe, before mentioned, fitted up especially for making tests, which can be run at speeds from 2 to 300 revolutions per minute, and will take work up to 60 inches in diameter. It is driven by an independent motor of 40 horse power, which gives us ample power for any desired test. We have on hand forgings of steel of different hardness, running from the hardest tool steel to soft merchant steel, and of wrought iron, also castings of steel and cast iron, with which we can carry out any test necessary to compare our treated tools with any others.

## MINOR MENTION

E. E. Witter, of Granville, O., is at work on a gasoline carriage of his own design.

J. E. Newton has the agency of the Locomobile Co. of America for Bristol County, Mass.

W. G. Hartman, of Portland, Ore., has nearly completed a steam carriage of his own construction.

The E. R. Thomas Motor Co., of Buffalo, N. Y., inform us that they have adopted the name "Autocrat" for their line of motor cycles.

Geiger & Brenning, of Salem, Mass., will manufacture gasoline motors for vehicles, and are reported to be at work on an acetylene motor also.

Syracuse is to consider an ordinance limiting the speed of all vehicles to five miles an hour within a half-mile radius of the center of the city, and to eight miles an hour beyond that radius.

Oliver H. Bair, a Philadelphia undertaker, has an automobile funeral wagon in successful use, and intends to add five more. The vehicle in question was built by the Fulton & Walker Wagon Co., of Philadelphia.

The Akron Automobile Police Patrol Company is being organized in Akron, O. It will have a capital of $200,000, and its principal plant will be in Akron. It is to control the patents of the Loomis automobile police patrol.

The Western Automobile Association, an organization for automobilists, has been formed in Chicago. It is intended that this association shall include among its members all the automobilists of the West. The officers are as follows: President, Arthur J. Eddy; Treasurer, D. Cottrell, M. D.; Secretary, Chas. T. Jeffery. Mr. Jeffery's address is the Virginia Hotel, Chicago.

The stable occupied by Albert R. Shattuck's motor carriages at Lenox, Mass., was recently destroyed by fire, most of the vehicles, together with some horses and horse traps and fittings, being saved. The fire appears to have originated from the attempt of Mr. Shattuck's motor care-taker to solder a leak in the gasoline tank of one of the vehicles without drawing off the gasoline.

The village fathers of Hempstead, L. I., passed an ordinance several weeks ago limiting the speed of motor vehicles to six miles an hour within the corporate limits. The result of placing the limit so low is that the ordinance is a dead letter already, and is almost universally ignored. The non-owners claim that the law is reasonable, while the owners of vehicles say that they will fight the law in court if necessary.

An automobile gymkhana, very similar to the one recently held at the Ranelagh Club, took place at the Sheen House Club on the last Saturday in July. A bending race, a race for hot-tube vehicles, starting from "cold," a coat and waistcoat race, an obstacle race, and a starting and stopping handicap, comprised the events. A ladies' race was on the program, but it did not take place, owing to the non-appearance of two of the three contestants entered. In the morning, before the contests began, members of the club availed themselves of the opportunity offered to train their horses in the presence of the vehicles.

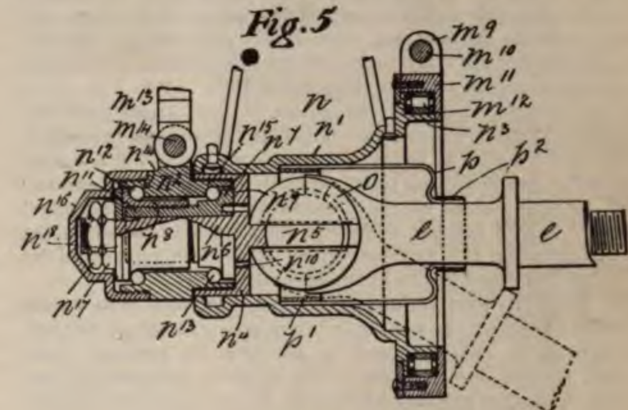
## MOTOR VEHICLE PATENTS ∴ ∴ OF THE WORLD ∴ ∴

### UNITED STATES PATENTS.

653,801—Motor-driven Vehicle.—Robert F. Hall, of Mosely, England. July 17, 1900. Application filed September 14, 1899.

The object of this invention is to make both front and rear wheels drivers and steerers as well. A further object is to render the frame flexible, to avoid strain from inequalities in the road surface. To this end the front and rear parts of the frame are made separate (a and b), and are joined by transverse members $a^5$ $b^5$ and yokes $c^2$ $c^5$, etc., connected by bolts $d^3$ in curved slots, so that one yoke can oscillate relatively to the other about a center in the axis of the vehicle. The differential gear drums $d^6$ $f^6$ of the front and rear axles are connected by a sprocket chain l, which runs over another sprocket wheel on the shaft of the motor, the cylinders of which latter are indicated at $g^1$ $g^1$. The wheels are carried in steering forks, which

Fig. 5



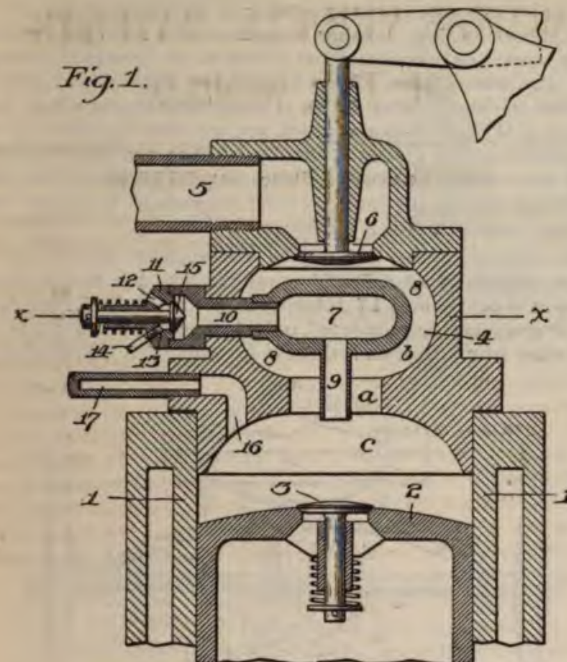
653,801.

are swiveled in the usual manner, crossed links $v^1$ $v^2$ connecting the steering gear of the front and rear axles. Universal joints, having their centers in the axes of the steering forks, transmit the driving power from the axles to the wheels. Fig. 5 shows in detail one method of accomplishing this.

653,854—Oil Engine.—Viggo V. Torbensen, of Westville, N. J., assignor, by mesne assignments, to the Manhattan Oil Motor Co., of Newark, N. J. July 17, 1900. Application filed August 19, 1898.

The object of this invention is to maintain the temperature of the vaporizing and igniting chamber of a kerosene engine at a uniform temperature after the engine has been started. This is accomplished by putting it inside the combustion chamber, instead of relying on the walls of the latter to do duty as vaporizor and ignitor.

In the drawings, 7 is the vaporizing and igniting chamber, 4 the combustion chamber, 2 the piston, 3 the inlet valve, and 6 the exhaust valve. 17 is the hot tube used for ignition when starting the engine. The oil is injected through the tube 14 and air enters at 12 from the suction of the piston, the two becoming commingled and sprayed together as they enter the chamber 7. The oil is here vaporized, the vapor issuing from the mouth of the short tube 9 and absorbing heat from it in the process. As the tube 9 is thin, it is readily cooled by the oil vapor, and does not become hot enough to fire the charge.



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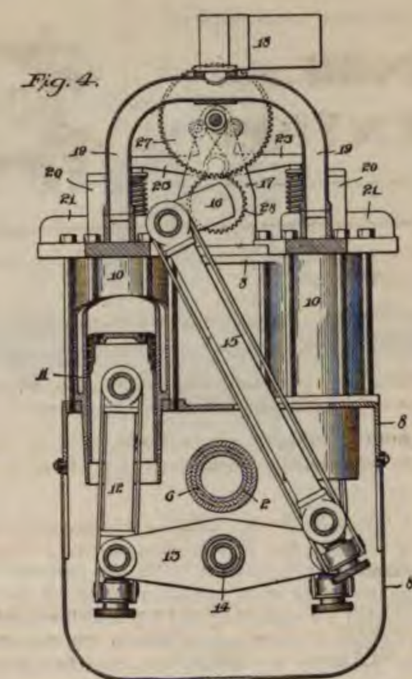


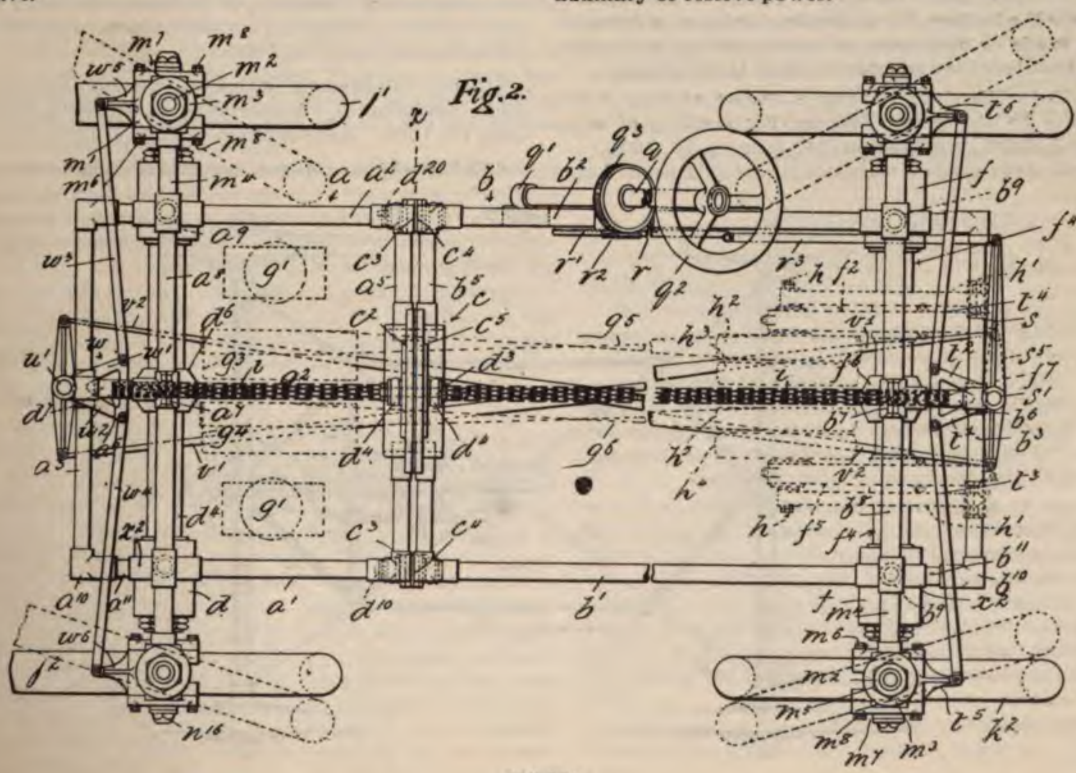
653,855.

On the up-stroke the piston compress the vapor and air together into the combustion, where they are ignited by contact with the red-hot outer walls of the chamber 7. As the exhaust gases pass by the chamber 7 on their way to the exhaust valve, the temperature of the walls of this chamber is determined mainly by these gases, and hence they can never become overheated when the engine is working under heavy load, or cooled when the load is light, as regulation is effected by closing the exhaust valve.

The jet of air drawn in by the orifice 12 is relied on to atomize the oil sufficiently to start the engine.

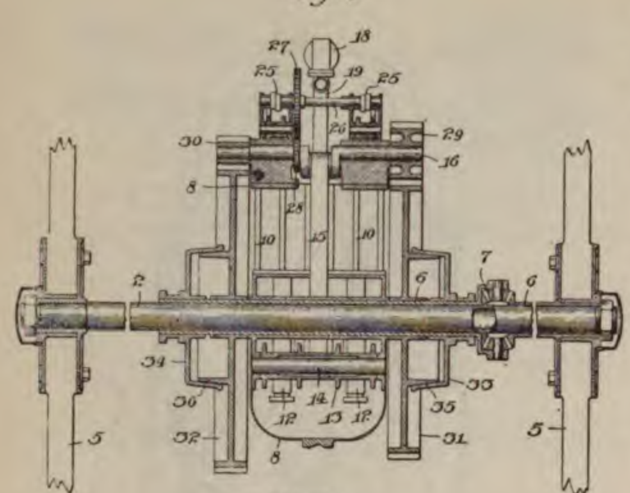
653,855—Motor Vehicle.—Viggo V. Torbensen, of Bloomfield, N. J., assignor to Geo. T. Harris, of Philadelphia, Pa. July 17, 1900. Application filed December 2, 1899.

This invention comprises a gas or oil engine, mounted directly on the driving wheel axle, and geared thereto by single-reduction gearing, and an electric motor and storage battery for auxiliary or reserve power.



953,801.

Fig. 7



653,855.

The engine has four cylinders, with the pistons working in pairs on opposite ends of a walking-beam 13, to one end of which is journaled a connecting rod 15, which actuates a crank shaft 16. The crank shaft has a pinion, 29, 30, at each end, meshing with gears 31, 32, which turn loosely on the sleeve 6 on the axle. Being of different sizes, these gears give different speeds. By means of the clutches shown they are connected to the sleeve 6. The sleeve transmits the power to the pinions 7 of the differential, and one bevel gear of the latter is keyed to the axle 2, while the other is on a sleeve, also marked 6, which is fast to the hub of the other wheel. Thus the axle 2 is continuous clear through, and perfect alignment is thus insured.

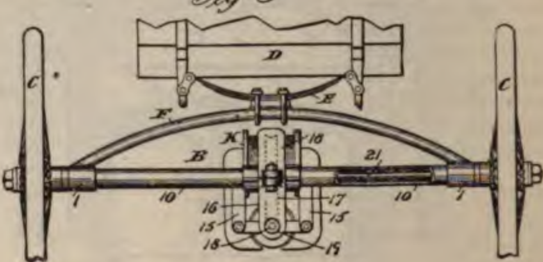
The electric motor, which is not shown in the drawings reproduced, drives a pinion, meshing with the gear 31, and by reversing the armature current, the reverse motion of the vehicle is obtained. On easy roads the surplus power of the engine is used to charge the battery, the motor here acting as a dynamo, and on bad roads or up grades, or when starting the engine, he power thus stored is available to assist in propulsion.

653,877—Motor Carriage.—Frank A. Perret, of New York, N. Y., assignor to the Perret Storage Battery Co., of same place, July 17, 1900. Application filed January 25, 1900.

This invention comprises a frame for motor vehicles, and also a motor and gear transmission for the same. The front and rear axles are substantially similar in outline, and are of the form shown in Fig. 3, being composed of a straight member and a curved or arched member joined to the former at its ends, near the wheel hubs. Two transverse semi-elliptic springs support the body. The frame is essentially composed of two V-frames H H, of T-irons, which are swiveled together by the long bolt 3 at the apexes of the V's, so that any wheel can lift with out raising the others. Brace-bars 13 13, jointed at their ends maintain the distance between the ends of the axles, and tubular braces 12 stiffen the frames.

The electric motor is hung in the manner shown, and a worm, connected by a flexible coupling 5 to the motor shaft, drives a worm wheel 17 interposed in the divided rear axle. The worm wheel is connected only to one of the rear wheels, the other being free, and there is no hint of a differential—a

Fig. 3



653,877.

rather remarkable arrangement, and one which is likely to be modified before the vehicle gets on to the market.

653,879—Motor Vehicle.—L. J. Phelps, of Melrose, Mass. July 17, 1900. Application filed May 19, 1900.

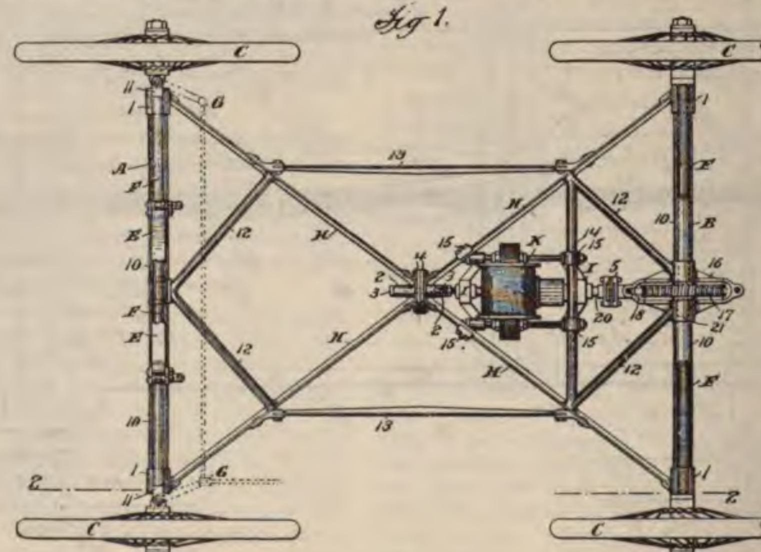
A safety device, which automatically stops the vehicle when the driver gets up from his seat.

653,957—Magneto-electric Generator for Gas Engine Igniters.—Garrett W. Henricks, of Indianapolis, Ind., assignor to the Henrick's Novelty Co., of same place. July 17, 1900. Application filed April 30, 1900.

654,027—Pneumatic Wheel.—J. Shellabarger, of Rockford, Ohio, assignor of one-fourth to J. W. Smith, of same place. July 17, 1900. Application filed June 7, 1900.

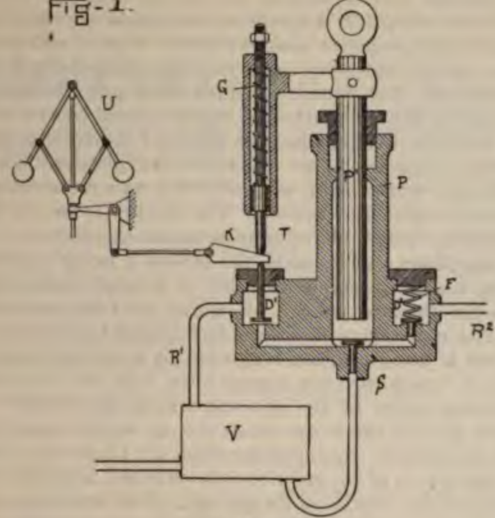
654,140—Apparatus for Regulating Fuel-Supply of Interna

Fig. 1.



653,877.

FIG-1.




654,140.

Combustion Engines.—Rudolf Diesel, of Munich, Germany, assignor to the Diesel Motor Company of America, of New York. July 24, 1900. Application filed September 10, 1898.

This invention, by the inventor of the celebrated Diesel engine, is illustrated diagramatically in the two figures shown herewith. The form shown in Fig. 1 is particularly applicable to gaseous fuel, and that shown in Fig. 2 to liquid fuel.

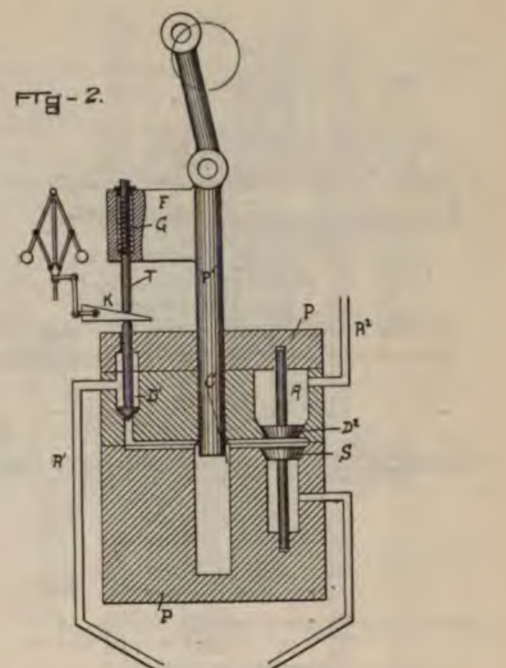
C is the pump chamber; S, the suction-valve of the pump; $D^1$ and $D^2$, discharge-valves, of which $D^1$ is connected to the fuel-supply by a pipe $R^1$, and serves to return the excess of fuel to the supply chamber or pipe V, while the balance passes through the valve $D^2$ and pipe $R^2$ to the combustion chamber. By any suitable means, such as a spring E, or by the pressure beyond it, the valve $D^2$ is loaded more heavily than the valve $D^1$, so that unless the valve $D^1$ is throttled during part of the stroke, all the fuel is returned to the supply.

T is a stem held down by a spring G, and located within a casing F, connected with the plunger $P^1$, so as to cause the stem to move up and down with the said plunger. During its downward motion this stem closes or throttles the return-valve $D^1$ for a certain period of time.

K is a wedge interposed between the stem T and the stem of the return-valve $D^1$, and so connected to the regulator of the engine that it is moved in and out from between the two stems, thereby regulating the time and duration of throttling or closing of the valve $D^1$, which time may be further regulated by the tension of the spring. Thus the fuel actually delivered to the combustion-chamber is regulated by the governor of the engine. The wedge K may be replaced by any other usual device, serving the purpose of closing or throttling a valve by the action of the governor, or it may be adjusted or set by hand.

In Fig. 1 the discharge-valves are connected to the lower end of the pump-chamber C, and this form is particularly adapted for the use of gaseous fuel. When, however, leakages in the pump itself occur, or when part of the pump-chamber is apt to be filled with vapors of petroleum—as, for instance, after a long stoppage—its action is less certain. The form of the apparatus shown in Fig. 2 overcomes these difficulties. In this form the return-valve $D^1$ is located higher than the top of the pump-chamber C, and is connected to the top of the feed-chamber, while the lower face of the feed-valve $D^2$, when closed is about in line with or below the top of the pump-chamber C, so that any vapors or gases in the feed-chamber will rise to the return-valve $D^1$, so long as the feed-valve $D^2$ is closed. The chamber above the valve $D^1$ extends above the outlet to the return-pipe $R^1$, and is open at the top around the valve-stem, so as to allow air and vapors to escape through the return-pipe $R^1$. The arrangement shown for closing or throttling the return-valve D is substantially the same as shown in Fig. 1. The automatic ventilating and return-valve $D^1$ opens during the first part of the pressure-stroke, allowing all the air and vapors to escape and a portion of the petroleum to return to the fuel-supply until the stem T closes it, whereupon the feed-valve $D^2$ is forced open and fuel supplied to the motor.

FIG-2.




654,140.

654,741—Motor Vehicle.—H. W. Libbey, of Boston, Mass. July 31, 1900. Application filed August 24, 1899.

654,742—Automobile Truck.—H. W. Libbey, of Boston, Mass. July 31, 1900. Application filed October 18, 1899.

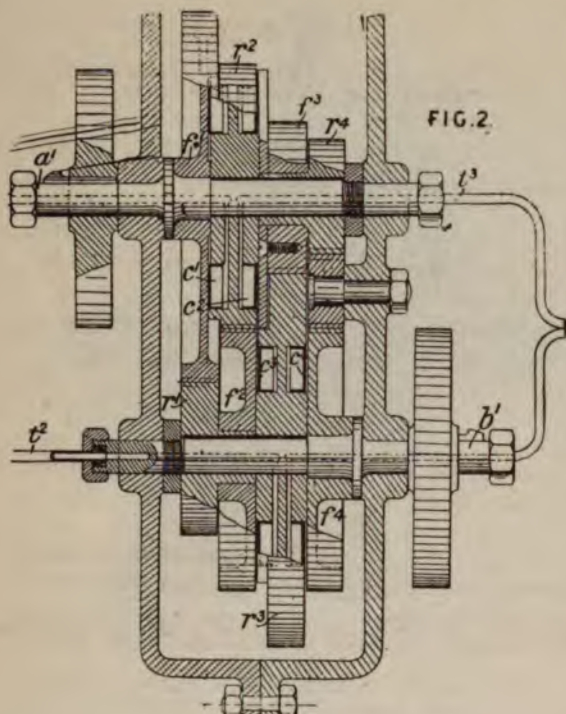
655,132—Friction Clutch.—Edward Toole, Gloucester City, N. J., assignor of one-half to Wm. F. Bokum, Philadelphia, Pa. July 31, 1900. Application filed March 19, 1900.

## BRITISH PATENTS.

6,724—Motor Vehicles, Boats, etc.—H. M. L. Crouan, of Paris, France. March 28, 1900.

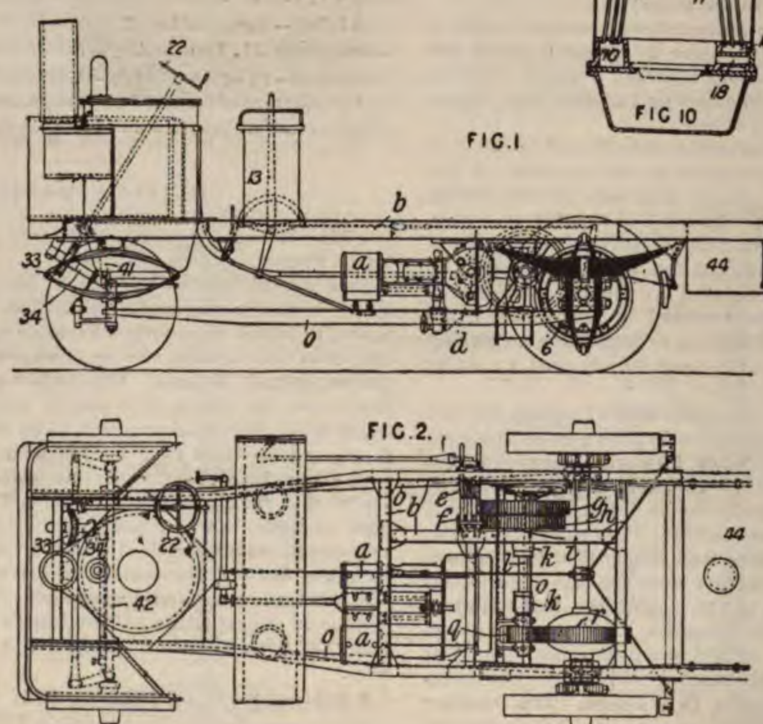
This patent relates to clutch devices for motor vehicles, stated in the Provisional Specification, to be also applicable to boats, in which the toothed variable speed and reversing gear, and also the brakes, can be changed or put in and out of action by fluid pressure. Fig. 2 shows the driving-gear partly in section. In this, motion can be transmitted from the driving-shaft $a^1$ to the driven shaft $b^1$ by either of the loose wheels $f^1$, $f^3$, or fast wheel $r^4$ in conjunction with one of the corresponding wheels $f^2$, $f^4$, and $r^1$ according to the adjustment of the friction clutches carried by the fast discs $r^2$, $r^3$. These discs have grooves, in which are lodged leathers $c^1$, $c^2$, $c^3$, $c^4$, behind any one of which the fluid under pressure can be admitted by means of ducts in the shaft, suitably connected by pipes $t^2$, $t^3$, etc., with a multiple-way plug cock. The brake device may be similar in construction and action to the clutches, or may be furnished with a series of plates for multiplying the frictional grip.

6,828—Motor Road Vehicles.—J. E. Thornycroft and Steam Carriage and Wagon Co., Chiswick, Middlesex, Eng. March 29, 1900.




6,724.

This invention relates mainly to the driving and steering gear, and also comprises a special construction of steam generator for motor-propelled road vehicles. Figs. 1 and 2 show respectively a side elevation and plan of a vehicle illustrative of the invention. The motor *a*, which may be a steam engine or other motor, is arranged below, and is carried by the vehicle frame *b* with its driving-shaft *d*, situated horizontally and transversely. On one end of this shaft are pinions *e*, *f* which can be slid in or out of gear with wheels *g h* on a second short shaft *i* so as to give two speeds. The shaft *i* is connected to a short shaft carrying a pinion *q* by an intermediate shaft *l*, with universal couplings *k* at its ends, the pinion *q* being supported on a lower frame or perch *o*, so that it is kept constantly in gear with the balance gear *r*, by which the road wheels are driven. The connection between the balance gear and the road wheels is not rigid, but is effected by laminated carriage springs 6, of which the ends engage with lugs on the wheels. The swivelling axles of the steering-wheels are adjusted by worm gear 22, 33, the worm shaft 34 of which turns at its lower end in a socket, supported by links 41, 42, in such a manner that the action of the steering-wheels is not interfered with by the play of the vehicle on its springs. Coal bunkers may be provided at 13 and 44. In the case of a steam motor being employed, the boiler may be of the water-tube type, constructed as shown in Fig. 10. This boiler is composed of two annular vessels 9, 10, connected by an annular group of inclined straight water tubes 11, the top and bottom plates 12 of the annular vessels being removable, to afford access to the tubes. Fuel is introduced through a door at the top, and a passage 18 may be provided for clearing the grate.


6,828.

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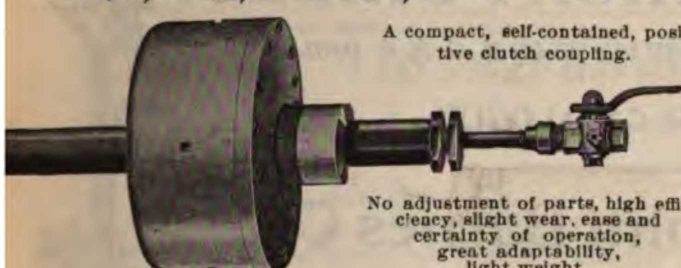

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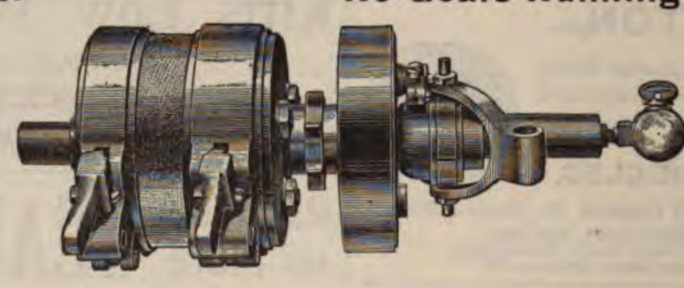

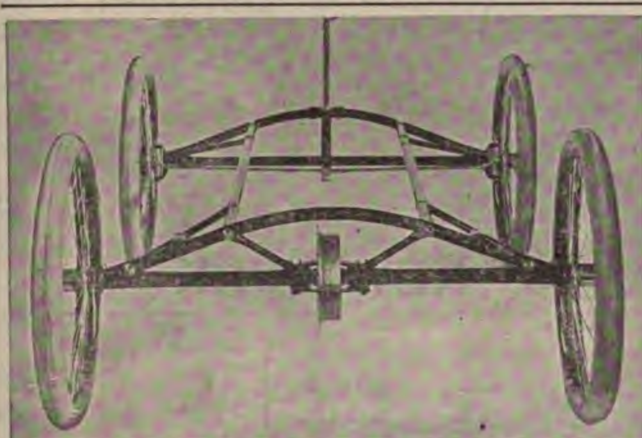





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Devoted to Motor Interests

VOLUME VI NEW YORK, AUGUST 15, 1900 NUMBER 20


## THE HORSELESS AGE.


E. P. INGERSOLL, EDITOR AND PROPRIETOR.

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**Number of Horses Prostrated by Heat in Chicago during last week..................................2000**

**Number of Automobiles Prostrated by Heat in same length of time.................................None.**

## THE MOTOR TRUCK THE HORSE'S FRIEND.

THE extreme heat all over the country last week, and the similar visitation a month ago, are forcible reminders of the boon to the equine species which the motor vehicle will prove itself when it comes into more general use for commercial work. Up to the present time it has been used mainly for pleasure, but when all heavy loads are moved by mechanical power the overworked draft horse will cease to exist, and much cruelty now unavoidable will be spared.

## ROLLER BEARINGS AND SOME CONNECTED MATTERS.

THE question of the most suitable bearings for a motor vehicle is certainly a live one, and we are likely to continue to hear of it so long as the present marked diversity of practice in this regard continues. Builders in this country, so far as we are aware, have from the first considered ball or roller-bear ing axles or hubs a *sine qua non*, and would regard as reactionary any suggestion looking to the substitution of plain bearings. Builders in Europe, on the other hand, so far as they have tried anti-friction bearings, appear to have had satisfactory results with them only in light work, and while there may be instances of their use in voitures and commercial vehicles, we do not recall having noticed any such case. As the continental builders are far ahead of America in their experience with heavy machines, this would at first sight look like a proven case.

Quite possibly it is proven, for the place and conditions as they exist across the water. Presumably the European constructors have tested the best examples available of both systems, and knew their own minds when they made their choice. But if we grant this very reasonable supposition, we may, with equal plausibility, assume that American constructors have found anti-friction bearings satisfactory, since they use nothing else. There is certainly no reason for decrying the use of ball or roller bearings where they have been found successful here, because on another class of work other people have found other bearings of the same name unsatisfactory. For one thing, there is a great difference between different bearings, even though all be called ball bearings or roller bearings. Patents have been granted on "ball bearings" whose balls could not by any possibility roll. To design a ball bearing which shall operate without rubbing friction calls for either mathematics or a lucky star. It used to be thought that the smaller the balls, and, therefore, the more "points of contact" in a given space, the greater would be the practicable load. The contrary is the case, and more ball bearings have probably failed owing to undersized balls than to any other one feature of design. The necessity of microscopic limits of error in size or shape is rarely appreciated till taught by experience. Uniform balls are made now at moderate cost, but a few years ago balls cost a good deal and were anything but uniform.

The same remarks apply in large measure to roller bearings. One does not need to be much of an expert to pick out roller

bearings, from the many on the market, which can not possibly roll without rubbing; and the need for exact measurements and workmanship is quite as great as with ball bearings. Satisfactory ball and roller bearings have waited till now for recognition because refined machinery is needed for their production on a commercial scale; and we can readily believe that part of the failure of these bearings abroad has been due to lack of those refined and rapid mechanical appliances in which American shops stand preëminent over all others.

Granting, then, that the anti-friction bearing must succeed here if anywhere, for a given service, the practical question is: What may we expect of these bearings, and of roller bearings in particular, when it comes to heavy work in this country?

Perhaps as good an answer as any is to point to the undisputed fact that these bearings effect an important saving in power. It is not in the nature of man, and certainly it is not in the Yankee blood, to stop short of any improvement whose advantages have once been demonstrated. The roller bearing, successfully applied to the motor vehicle, enables a lighter motor to perform the same work as a heavier one with plain bearings. The lighter motor means smaller tanks, lighter construction, less wear and tear, and less expense all around. It is scarcely to be imagined that, with these benefits in sight, inventors will fold their hands before the prize is within their grasp.

The important fact should not be forgotten, however, that the friction of the wheels is only an item in the total friction loss between the motor and the tires. Not all of the loss is in the bearings; a substantial percentage of it is in the gears and the sprocket chain or chains. But every gear shaft has at least two bearings, and, while we have no data at hand indicating the percentage of loss here and at the wheels, yet it is obviously a mistake to neglect the former, as if no friction of consequence existed save at the axles.

To apply ball or roller bearings in the transmission, however, is far from being a simple problem. The extreme hardness of the bearing members calls for great exactitude of alignment, and this can be secured only by exceptional rigidity of frame or by mounting the shells of the bearings in spherical seats, as is the practice with the main bearings of electrical machinery, in order that they may be self-aligning. The former method is hardly compatible with the present American practice of interposing the springs between the frame and the body, instead of between the axles and the frame, although it can be accomplished by making the transmission self-contained and using flexible connections between it and the motor and the axles. Spherical seats, on the other hand, not only add substantially to the cost but give the gears a chance to run desperately out of line before attention is given them.

It is quite probable that provision for self-alignment would be needed if the mechanism were carried on a spring-supported rigid frame, as is the European practice, but this would be in the nature only of a concession to the unyielding nature of the bearings, and would not imply an impending destruction of the gearing. It is certain that this arrangement, apart from its other advantages or disadvantages, presents a correct solution of the problem of alignment. What may be called the opposite extreme, that of mounting the motor and transmission directly on the axles or on the frame connecting them, has little or nothing to recommend it beyond its initial simplicity. It is easy to combine rigidity of the mechanism with flexibility of relative movement between the front and rear axles, by swiveling the front axle on a ring-bolt at the front end of a rigid frame. This gets over the alignment difficulty, but it imposes the whole weight of the motor, transmission gear and frame as a dead load on the tires. Pneumatic tires are admirable cushions for small shocks, and on asphalt or new macadam they would do very well alone; but their range is very short, and they are altogether insufficient to absorb properly the vibrations arising from the irregularities of ordinary roads. It has been proven time and again that, where machinery is carried as a dead weight on pneumatic tires, the life of both tires and machinery is very greatly shortened. It may be taken as absolutely essential to the correct design of a motor vehicle of ordinary size and weight (not a tricycle) that not only the body but the machinery should be spring-suspended.

To inquire whether the machinery should be mounted within the body or separately suspended would carry us beyond the scope of the present inquiry. The disposition and vibration of the motor will have something to do with this question; but the fact that the former arrangement is the preferred one in practice gives it the weight of *a priori* argument. Either arrangement, however, would allow of roller bearings being used, and we believe that the future tendency of design will be toward one or the other of these two forms.

Our readers will be interested, in this connection, in the specifications of the patent recently issued to Edw. P. Cowles, of which an abstract is given on another page this week. By the use of an ingenious friction device the weight of the transmission is reduced probably 50 per cent. from what it would be if gears were used, and the use of flexible shafts from the motor enables the latter to be spring-suspended in any way desired. Assuming that the friction rollers are made sufficient for their work, and that their bearings are able to withstand the heavy pressure imposed, nothing so promising has for a long time come to our notice. The question at this moment is: Why cannot roller bearings be used with those friction rollers?

## A SIGNAL NEEDED.

THE comment is sometimes made that the bells commonly used on automobiles are not distinctive enough in sound to serve as a warning when used in the midst of trolley cars on the one hand and bicycles on the other. If one particular kind of bell were used on motor carriages, and if this were sufficiently unlike the bells used on either of the other conveyances mentioned, everyone would soon learn to recognize and heed the warning. Unfortunately, there are very many kinds of automobile bells, and no small proportion of them might easily be taken, by their sound, to belong to cable or trolley cars, to bicycle scorchers, or even to bakers' wagons, at greater or lesser distances. That this fact carries possibilities of both annoyance and danger needs no argument. Every wheelman can testify to the exasperating indifference of the public to a small bell. It is heard, but in the multitude of other noises it is not heeded till the wheel is close at hand. That the pedes-

trian hearing the bell of a motor carriage should suppose himself safe because he is not on the street-car tracks, is an even more serious possibility. On account of the high speed of the automobile, its signal should be instantly recognizable at a distance. It need not be loud, but it must be characteristic.

Probably the most distinctive thing now in use is the horn adopted in France. Possibly the reason why it is not more commonly adopted in this country is that, as at present arranged, it must be worked by the hand, whereas American builders prefer to assign minor operations to the feet, leaving the hands as free as the prime work of steering and speed controlling will permit. This would seem to be a chance for the inventor of the air-pump whistle to adapt his contrivance to motor vehicles.

Let drivers agree, if they can, on a single characteristic signal, and then drop the others. The public will thank them and they will congratulate themselves no less.

## "BLINDED" HORSES.

IT is a matter of common observation that the horse with blinders is more apt to take fright at objects in the road than the horse whose vision is not thus obstructed; and this is usually and naturally explained by saying that the former, being unable to see the supposed hostile creature after he has passed it, fancies it to be pursuing him. This is without doubt the principal reason for the fact observed; and we fancy that if the animal's masters were to be similarly encumbered, and then compelled always to look straight ahead, it would not take a great deal to develop in them something of the same timorousness.

Recently, however, we have seen it suggested that the blinders may sometimes act as disturbers in another way. The inner side of the blinder is concave, and is supposed to be a dead black. By repeated cleaning, however, it may gain a certain degree of polish; and in this condition it is adapted to reflect light into the horse's eyes to a very confusing if not injurious degree, while even light-colored objects may thus be doubled, the form of the blinder magnifying or distorting them.

The point seems worthy the attention of horse owners; but whether it proves of much or little weight, we think that many an owner of a "blinded" horse has only himself to blame for the animal's timidity.

IN the last issue of THE HORSELESS AGE, on page 14, the caption of Fig. 8—"Plan and Elevation of the Gardon Transmission Gear"—should have read "Plan and Elevation of the *Gandon* Transmission Gear." By reference to the text it will be seen that it illustrates the transmission from engine to front axle, of the steam truck of that name.

## THE MARSH MOTOR BICYCLE.

A new motor bicycle, in which the motor appears to be somewhat better adapted to the bicycle than is sometimes the case, has just been brought out by Marsh Bros., of Brockton, Mass., and is illustrated herewith.

The weight of the machine, when ready for the road, is 60 pounds, and it carries an air-cooled four-cycle motor, 1⅞ inches bore by 2¼ inches stroke, geared through a sprocket chain to the rear wheel.

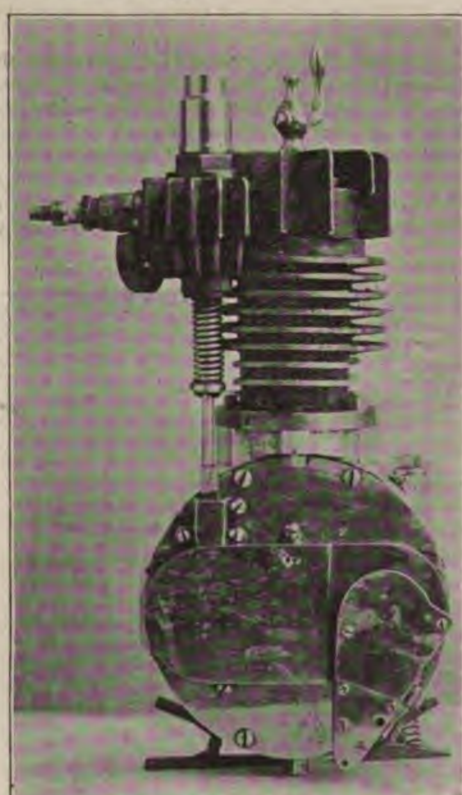
The motor, as will be seen, is placed fairly low, being just forward of the seat mast or vertical member of the frame. This location has been selected for it by its makers after considerable experience with placing the motor on the front fork and over the rear wheel back of the saddle, and they are convinced that this is the only practical place for it. To get the motor in here, however, it has to be made very narrow, in order not to interfere with the cranks or necessitate a tread of ungainly width.

MARSH MOTOR BICYCLE

This has been accomplished by making the crank-pin, which is $1\frac{1}{16}$ inches long, overhang the main bearings. The inner ends of the bearings are only $\frac{3}{4}$ inch apart, this giving space for the connecting rod, for the two 6-inch steel disks which constitute the cranks and fly wheels, and for clearance between the rod and the disks. The bearing next to the sprocket pinion is $1\frac{1}{4}$ inches long, and the other is 1 inch long. The over-all width of the motor is only 4 inches. As will be seen from the photographs, width is saved by putting the exhaust valve somewhat back of the axis of the cylinder, instead of just over one end of the shaft, as is customary. The unusual narrowness of the motor is well shown. The crank case is 7 inches in outside diameter. The makers state that after having run the machine nearly 1,000 miles, an inspection of the motor bearings showed no sign of wear.

The rear wheel has a coaster brake hub, with the releasing gear and brake on the right-hand side, and the 32-tooth sprocket, to which the motor is connected, on the left. The motor shaft makes $6\frac{2}{3}$ turns to one of the rear wheel, and Marsh Bros. inform us that it will carry a person of average weight from 20 to 25 miles an hour, with no pedaling except when going up the steepest hills.

Jump spark ignition is used, and the battery cells, four in number, each $1\frac{1}{16}$ inches diameter by $1\frac{7}{8}$ inches long, are placed end to end in the horizontal tube, strapped to the top member of the frame. The spark coil is contained in the case hung from the front part of the same member. The fuel tank, of one quart capacity, is fastened back of the seat post by the lug shown, and just below it is the vaporizer, which appears to be of the constant level type.



MARSH BICYCLE MOTOR.

Between the rear wheel and the lower part of the seat mast is the muffler, which is secured to the latter. The seat mast is used to convey the exhaust gases from the motor to the muffler, and is made of 10 guage tubing, 16 gauge tubing being used elsewhere. The fixture just back of the motor cylinder is an air scoop, to carry warm air from the motor to the vaporizer.

MARSH BICYCLE MOTOR.

On July 2d, W. T. Marsh rode the machine from Brockton to Plymouth and back, 25 miles each way, in 2 hours 35 minutes. Between the time when he left Brockton and the time of leaving Plymouth, 1 hour 35 minutes elapsed, and the return trip was made in 63 minutes. Mr. Marsh did not use his feet to assist the machine during the entire trip, with the exception of the big hill at Kingston, which is $\frac{1}{3}$ of a mile long and very steep.

Marsh Bros. do not, of course, intend their outfit for racing purposes, but they believe that it carries ample power for general use in the hands of the public, and that greater power would be liable to lead to accidents. They will devote themselves exclusively to the manufacture of these machines in the future, and will sell the motor or any part of it, or any fixture, separately if desired.

## THE SIMPSON-BODMAN SYSTEM IN AMERICA.

The Milwaukee Automobile Co. inform us that W. L. Bodman, of Simpson & Bodman, Manchester, Eng., has made arrangements with them to develop and construct sample vehicles on the Simpson-Bodman system at their factory, with such modification as seem necessary to adapt them to American roads. Mr. Bodman has expressed himself as astounded by the severity of the conditions that must be endured in this country by the motor vehicle intended to go on any horse road at any season of the year.

The Milwaukee Automobile Co. have been very largely influenced to make arrangements with Mr. Bodman by the fact that, while there are at present no statutory limitations on the use of self-propelled vehicles in this country, yet there is always the possibility that, should any type be put on the market which was injurious to the roads or a nuisance to other traffic, some limitations to their use would be made. A careful testing in Lancashire has convinced the Milwaukee company that this system has been developed on Lancashire roads most nearly approximating to the road surfaces in the cities of this country, and in compliance with the most onerous requirements of use, cost, ease of control and safety.

## ON MOTOR POWER.

BY L. BERGER.

The internal action of a high-speed gasoline engine is examined on its diagram. This latter is not easy to obtain, and aside from its indications of the effect of variations in the point of ignition and the initial and terminal pressures, the other values of P and T, and the variation of the entropy E, or of the quantities of heat, are of only theoretical interest. Such a diagram must be supplemented by a study of the losses and the causes of reduced power in the motor, in order to get practical improvement in its organs. The following losses can be called "constant," or almost "constant" losses, viz.:

(1) The non-instantaneousness of the explosion, of which the effect is increased by the sluggishness of the contact spring in electrical ignition. For an average good running motor, with proper lead, it is negligible in comparison with the other causes of trouble.

(2) Loss of heat in the water-jacket, or by the walls and head of the cylinder. For an average motor this may be taken as about 50% of the heat of the explosion.

(3) Loss due to the heat remaining in the exhaust gases; this is about 50% of the remaining heat of the explosion.

(4) Rarefaction of the in-drawn air and mixture in the carbureter and the cylinder during the admission.

Considering the value and the speed of heating in the ordinary hot-air motors (the Lehman, for instance), we can admit that the temperature of the air and mixture reached hardly 40° C. in the cylinder, if the admission is made at 15° C. This increases the pressure of the air from 1 to $\frac{274+40}{274+15}=1.09$; and as the tension of the gasoline vapor of the mixture is 215 mm. of water at 15°, and 410 mm. at 40°, the absolute tension of the vapor will be increased only from 1 to $\frac{10.410 \text{ m}}{10.215 \text{ m}}=1.02$, the atmospheric pressure being equal to 10 metres of water. The density of the mixture is, therefore, reduced from 1 to $\frac{1}{1.09}=0.92$, giving a loss of 8 per cent.

(5) Resistance of the suction valve, due to the tension of its spring.

If T is the tension and S the area of the valve, the value $\frac{T}{S}$ will represent the lost pressure of the indrawn air. In the case of a tension of 2 pounds for an inner diameter of 1½ in., the loss will be $\frac{2}{1.766}$ lbs., or $\frac{2}{1.766 \times 14.7}=8$ per cent. of the atmospheric pressure.

Further investigation on these five constant sources of lost power cannot be undertaken in this study; we must pass on to more important and less well-known causes of trouble—those which vary with the speed of the motor.

The speed of the air in the suction apparatus often averages from 40 to 50 yards per second in the pipe, giving a resistance corresponding to about 0.06 of the atmospheric pressure, and increasing quickly to 0.3 and more with the speed. This resistance of the suction increases with the square of the speed of the air, and the lost pressure can be calculated by a piezometer. We indicate here a simple method by which this resistance may be calculated by noting the speed of the motor when running free. Let P be the net available power remaining per stroke after the five causes of loss above mentioned. Let $N_0$ be the number of revolutions per min. of the motor running free. Let $N_1$ be the number of revolutions per min. for the ordinary work of the motor in question. Let $P_1$ be the power for this work, by the diagram, and $P_0$ the power by the diagram for $N_0$ revolutions.

The resistance of the suction for $N_1$ revolutions will be proportional to $N_1^2$, and may be designated, therefore, as $An_1^2$.

The remaining propulsive power $P_1$ will consequently be equal to $P—An_1^2$, or $P_1 = P—An_1^2$.

Likewise the remaining propulsive power $P_0$ on our diagram will be equal to $P—An_0^2$ for $n_0$ revolutions, the constant A being dependent on the form of the aspiration, which is the same for all cases of our motor. If we suppose that there is no power available in the cylinder for external work at the speed $N_0$, which is the case, because the speed cannot be increased, then, if we neglect the frictional resistance of the motor, the propulsive power $P_0$ will be 0.

Therefore we have $P_1 = P—An_1^2$ (1)

$P_0 = P—An_0^2$ (2)

$P_0 = 0$ (3)

And thence $P = An_0^2$ and $P_1 = P\left(1-\frac{n_1^2}{n_0^2}\right)$* (4)

This equation (4) means that if we know the net power P of the diagram of a motor running slowly, the available brake power $P_1$ at a speed $n_1$ will be given by this equation, if we know the number $N_0$ of revolutions of the motor running free. If we wish to take account of the frictional resistance R of the motor in the equation (4), we will have simply

$$P_1 = P\left(1-\frac{N_1^2}{N_0^2}\right)-R \qquad (5)$$

This frictional resistance R is readily obtained on our motor by considering the number of ignitions required to maintain a regular speed $N_1$, in the case of our motor running free. Supposing an interrupter on our electrical ignition, and our *motor running free*, we can let it run at any speed, $N_1$ for example, if we permit only, for instance, $m_1$ ignitions in a minute. The mechanic propulsive power being $P_1$ and the mechanical resistance being R in a revolution, we have, for the speed $n_1$, $m_1P_1 = n_1 R$, the total power $P_1$ being exerted $m_1$ times to overcome the frictional resistance of the motor at the speed $n_1$.

Therefore we have $R = \frac{m_1}{n_1} P_1$ (6)

In this equation $P_1$ has the value indicated in the equation (5), which in that case becomes by substitution and transposition:

$$P_1 = \frac{P\left(1-\frac{n_1^2}{n_0^2}\right)}{1+\frac{m_1}{n_1}}$$

Between two ignitions occur $\frac{n_1}{m_1}$ missed explosions, and the flywheel has the mean speed $n_1$, with a maximum during the power strokes, which has only the effect of making $P_1$ a little smaller. This maximum speed of the flywheel is obtained by the ordinary calculation. For the present purpose we may neglect it.

We will terminate this study, computing the real output of our engine from all things above mentioned, without laying out the real diagram, which can clearly be drawn from what follows: Let $P_0$ be the atmospheric pressure and K the proportional number by which $P_0$ is increased by the explosion of the mixture in our motor. This factor K is given by the temperature attained after explosion in the uncompressed mixture. Let $T_0$ be the absolute temperature before explosion, and T that after explosion, then K is equal to $\frac{T}{T_0}$ and practically to 5 or 6.

Let v be the volume drawn in by a stroke of the piston, r the proportional number of the compression. If $v_1$ is the volume

---

* $P_0 = 0.\quad P = An_0^2$

$$P_1 = An_0^2 - An_1^2 = An_0^2\left(1-\frac{n_1^2}{n_0^2}\right)$$

$$P_1 = P\left(1-\frac{n_1^2}{n_0^2}\right)$$

of the compression chamber, r will be equal to $r = \frac{V + v_1}{v_1}$

Let $\gamma$ be the ratio $\frac{S_p}{S_v}$ of the two specific heats of the mixture.

In our case $\frac{S_p}{S_v} = \gamma = \frac{0.280}{0.215} = 1.30$.

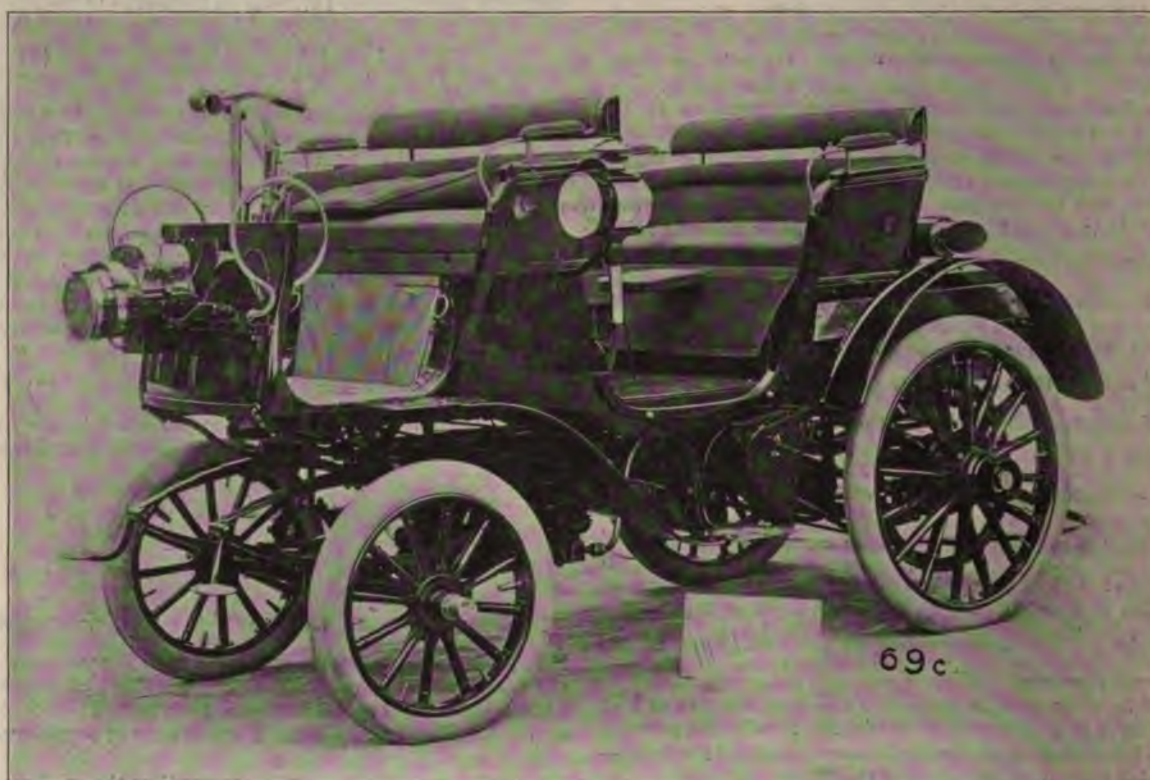
We have for the total energy of the sucked mixture, less the compression work:

$$E = \frac{p_0}{\gamma - 1} \times \frac{r^{1.3}}{r} \times v \times \left(K - 1\right)$$

Now let *a* be the proportion of heat remaining after loss by exhaust; *b* the proportional heat remaining after cooling by the cylinder walls and head; *c* the proportional work remaining after loss by heating of the mixture; *d* idem after loss by the suction value; e idem after loss by the rapidity of suction $= 1 - \frac{n_1^2}{n_0^2}$; *f* idem after loss by the frictional resistance.

All these values, K R *a b c d e f*, can be easily obtained in a given motor, and the equation (*a*) of Pw will indicate exactly the available brake power. We have only given the numerical example above, in order to show its perfect coincidence with the numerous empirical formula already proposed.

We see by the formula (a) that if we name a b c d e f $= \alpha$, the real output of the motor, $\alpha$ will be equal to 0.16 for our proposed engine. The pressure at the moment of release, which can raise on the theoretical diagram to 8 atm., will be only $8 \times 0.16 = 1.28$ atm., as real pressure, and if we arrange the exhaust with a well-closed box, 9 or 10 times greater in volume than that of the piston stroke, we see that the final resulting pressure will be not much higher than the atmospheric pressure, and near that given by the exhaust pipe resistance, and that it is possible without considerable lost power to suppress the noise by using only a small outlet in the exhaust pot.



NEW TYPE "VIERER" VEHICLE, NESSELDORFER WAGENBAU-FABRIKS-GESELLSCHAFT.

We have finally, therefore, for the real diagram work of the gasoline engine:

$$Pw = \frac{P_0}{\gamma - 1} \times \frac{r^{1.3}}{r} \times v \times \left(K - 1\right) \times a\,b\,c\,d\,e\,f. \qquad (a)$$

That is the exact formula from which we can derive a simple approximate one. We have seen above that we can take for an ordinary motor the following values of the numbers in the formula:

$K = 5 \quad a = 0.50 \quad d = 0.92$

$r = 4 \quad b = 0.50 \quad e = 0.84$ } If we suppose that $n_1 = 800$,

$c = 0.92 \quad f = 0.90$ } $n_0 = 2000$,

and R = 10 % of the work.

Put also n = the number of revolutions of the motor in a minute, and $P_0 = 14.7$ pounds p. sq. inches. We have, therefore, in H. P. the value approximately:

H. P. = 0,000071 nv.

v is given in cubic inches.

## A NEW GERMAN VEHICLE.

We take pleasure in presenting to our readers some capital photographs of a new two-seated vehicle built by the Nesseldorfer Wagenbau-Fabriks-Gesellschaft, whose racing machine was illustrated in our issue of July 4.

The larger photograph is taken from the rear, and shows the 9-h. p. motor with the body removed. As will be seen, the rear axle is dropped below the motor, and on the left side the long semi-elliptic spring, by which the frame is carried on that end of the axle, is clearly seen, as also the hub brake adjacent to it. A friction clutch of liberal dimensions is attached to the flywheel, and drives the sprocket pinion at the right, from which a chain runs to the speed-changing gear case midway between the axles. A metal pinion meshes with a rawhide gear driving the cams. Electrical ignition is used; the sparkers

appear to be of the quick-acting lift variety, and are worked by another cam on the secondary shaft. The affair at the top of the picture, about in line with the valve-stems of the engine, appears to be a magneto generator, but we shall have to leave our readers to guess at how it is driven. Our own conjecture is that the arm on the shaft rocks back and forth, and that there is some sort of a coaster brake between the shaft and the armature.

The makers tell us that dust-proof sheet metal covers fit over the igniters; and the wing nuts on the inner ends of the cylinders tell of the use of a similar cover, probably of cast aluminum, over the crank chamber.

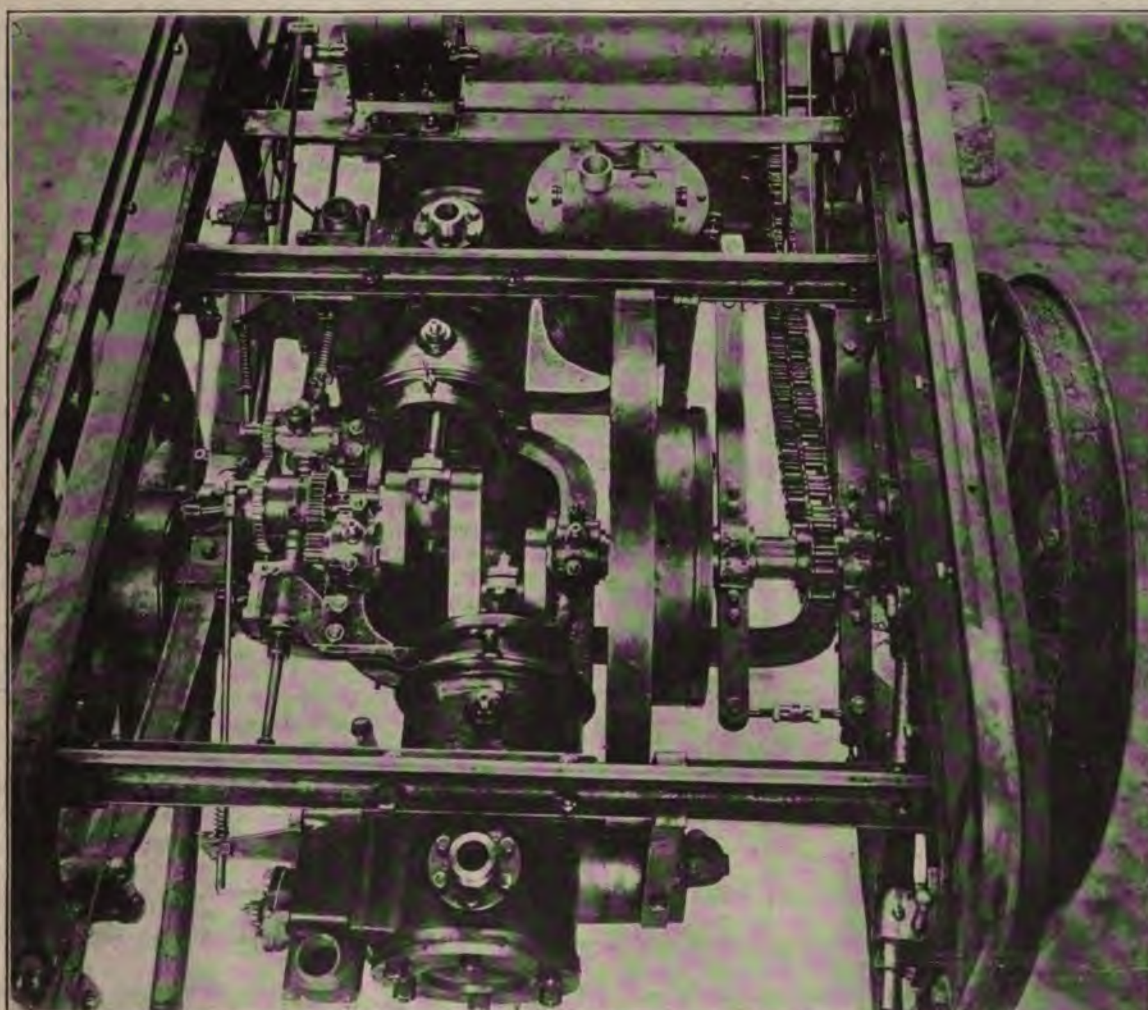
The wheels in this photograph are *sans* tires, but this fact can easily be forgiven, in view of the general excellence of the view.

# ...COMMUNICATIONS...

## CABMAN WANTS ALL THE ROAD.

*Editor* Horseless Age:

I was riding in an automobile on the public highways, near a railway station, accompanied by my wife and child: two



Motor of Nesseldorfer "Vierer" Vehicle.

horses, not tied, in cabs, were standing at the side of the road; I moved along slowly and passed one horse, but just as I was immediately passed the second horse he sprang sidewise, overturned the cab, broke the whiffle-tree and cleared himself from the carriage. He did practically no damage except as stated. The drivers were in a near-by loafing shop. I am asked to pay damages for repair of carriage and also for shock to the horse, caused by fright. Am I liable? I may add that I stopped, got out, and did all in my power to stop the horse and prevent further damage. Massachusetts.

[When the driver of a motor vehicle is proceeding at a rea-

## MOTOR CARS IN SPAIN.

The lumbering and slow "diligiencias" of Spain are about to be superseded by the motor car. Two lines of automobiles communication will be opened for traffic in the neighborhood of Coruna during the present year. One line will start from Betanzos, through Ferrol, via Ortigueira to Vivero, going through the most beautiful country, and connecting these places with the Northwestern Railway System of Spain. A line from Coruna to Santiago will be an immense boon, and will bring these important towns within four hours' communication of each other.

sonable rate of speed, and with reasonable regard to the rights of other users of the road, he cannot be held liable if horses take fright at his vehicle. Horses are liable to take fright at anything unfamiliar to them, and when the object is a thing in common or increasing use, it is the business of the horse owners to train their beasts to face it. Horses may take fright at obsolete conveyances as well as at novel ones, and the mere novelty of the vehicle cannot be made an obstacle to public progress.—Ed.]

## WHEEL AND TIRE SIZES.

Monaca, Pa., Aug. 9.

*Editor* Horseless Age:

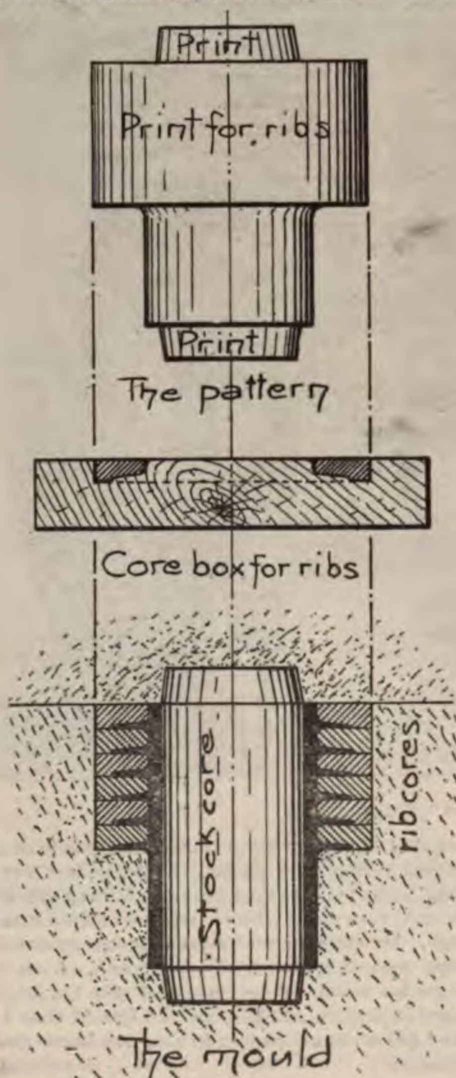
Which of the two sets of wheels proposed below would you consider preferable for use on a single-seated runabout and touring carriage for rough Pennsylvania roads?

(a) Thirty-four inch front, 38-inch rear, with 2-inch or 2½-inch tires.

(b) Twenty-eight-inch front, 34-inch rear, with 3-inch tires.

Geo. Moffett.

[Two-inch tires are rather small even for light carriages. Two and a half inches is none too large. So far as easy riding goes, we should not expect to find much difference between the two outfits, but outfit (b) would undoubtedly be cheaper. Perhaps some of our readers can add a suggestion.—Ed.]




Another Ribbed Cylinder Pattern.

## ANOTHER RIBBED CYLINDER PATTERN.

Phila., Pa., Aug. 6.

*Editor* Horseless Age:

The pattern for a ribbed cylinder shown on the enclosed sketch is easier to make than that described by Mr. Anthony in your issue of August 1, for this reason it will recommend itself to experimenters who wish to make only one or two castings.

Of course, the increased labor of molding by this method precludes its use for manufacturing purposes.

P. H. Beaumont.

## A SMALL STEAM MOTOR.

Hartford, Conn., Aug. 6.

*Editor* Horseless Age:

Will you please inform me through the columns of your paper the power of a pair of double-acting steam-engines of 2½-inch bore by 2¾-inch stroke with a boiler pressure of 175 pounds per square inch? Will a pair of engines of the above dimensions be powerful enough to propel a carriage weighing 550 pounds at 18 miles an hour? What are the dimensions of the cylinders in the locomobile? W. P. W.

1. About 3-h. p.
2. Yes, on good roads.
3. 2½ x 3½ inches.

## THE COST OF PAVEMENTS.

According to the *Inter-Ocean*, statistics show that in 1890 the sum of $391,400.73 was expended for repairing and improving the streets of Chicago. In 1894 $545,836.65 was expended, and for the year 1898 $479,194 went for the same purpose. On this basis an average of nearly $500,000 a year is spent for repairing and improving Chicago streets. In eight years, from 1890 to 1898, the total sum of $3,777,150.92 was expended for repairing and putting down pavements.

The average life of a pavement in Chicago, according to statistics, is as follows: Cedar blocks, five years; macadamized, five years. Asphalt and brick are guaranteed for ten years, and are good for 15 years if properly repaired.

The motor vehicle, with its heavy rubber tires, would not wear a pavement perceptibly during long years of service. The constant accumulation of dirt would be something then unknown, and the business streets of a city could be kept as clean and attractive as the boulevards.

## NARROW ESCAPE OF VANDERBILTS.

The following comes from Newport, under date of August 5. While we cannot vouch for its correctness, it does not sound incredible.

Mr. and Mrs. Wm. K. Vanderbilt, Jr., had a narrow escape from death last evening. They were returning home in their locomobile, and were riding at a good gait down Bellevue avenue.

At the end of the avenue is a sharp turn, and it was here that the accident happened.

Mr. Vanderbilt veered quickly around the corner, and as he did so he ran right into a fashionable turnout, drawn by a span of high steppers.

It looked as if a collision was inevitable, but Mr. Vanderbilt was quick to act, and the machine was brought to a sudden standstill. At the same time the horses reared up, pawing the air excitedly. The driver saw that he must keep the horse in the air until Mr. Vanderbilt could back out from under them. Mr. Vanderbilt soon had his machine at a safe distance, but none too soon, as he had hardly got from under the horses when they came to earth.

When Mr. Vanderbilt turned to his wife to joke away the fright he found that she had fainted and sat limp by his side. She was taken into a cottage and was soon revived.

# ...OUR... FOREIGN EXCHANGES

## THE AUDIBERT-LAVIROTTE TWO-SEATED VOITURE.

This vehicle, which is built by Audibert & Lavirotte, Montplaisir, Lyons, is described in a recent issue of *La France Automobile.*

As the photograph shows, it is a substantial two-seated vehicle, of dignified appearance, and is well suited for touring and the like. Its leading mechanical features consist in a horizontal two-cylinder motor in the forepart of the frame, belt transmission from the motor to the intermediate shaft, water circulation by gravity without a pump, and ignition by spark or hot tube, as preferred.

is interchangeable, and any style desired may be mounted on the frame. The wheels have bronze axle-boxes, and the spokes of the rear wheels are thickened where the sprocket wheels are bolted to them.

The steering hand wheel is inclined, and it acts on the front wheels through a screw, in the manner shown in Fig. 4. The steering tube is supported near its foot at two points, making it very stiff. All parts of the steering gear are of forged and tempered steel.

Though not mentioned in the description given by our contemporary, the drawing of the steering gear (Fig. 4) shows a "boîte à ressort," apparently an enclosed spring interposed in one of the links in the steering gear, to reduce the stresses due to the irreversible nature of the mechanism.

Although the plan drawing of the frame shows a gear transmission from the motor shaft to the intermediate shaft, on which the shifting gears are carried, the description states that a belt is here used, and the detail sketch, Fig. 5, shows the arrangement. A jockey pulley acting on the back of the belt is pressed against the latter by a foot pedal, by pressing

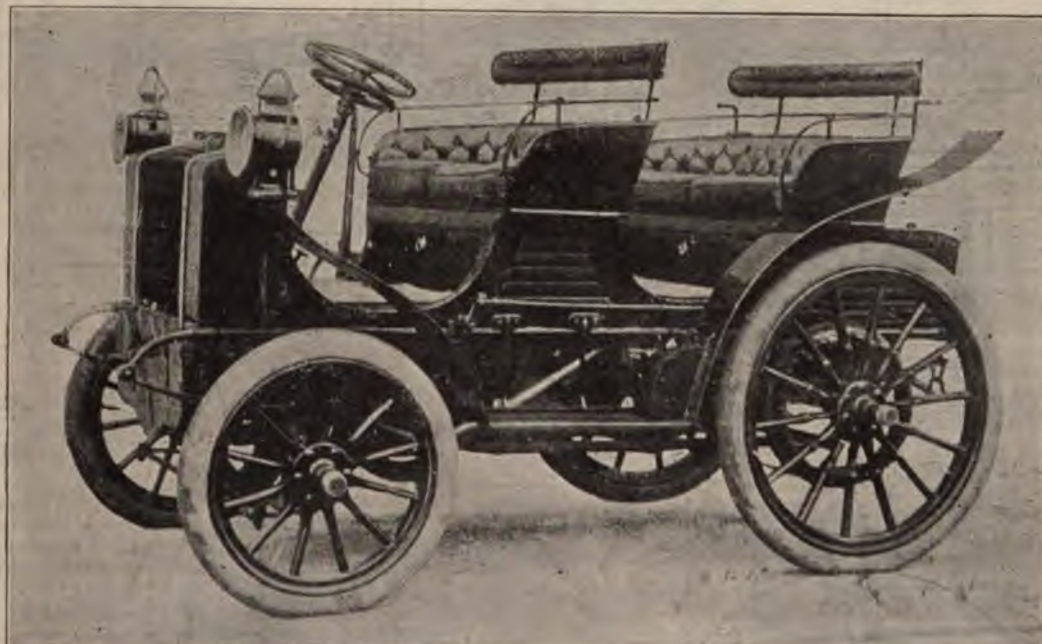


FIG. 1.—AUDIBERT-LAVIROTTE TWO-SEATED VOITURE.

The frame, shown in Figs. 2 and 3, comprises upper and lower reaches, connected together by vertical struts, after the manner of a built-up bridge girder, and joined by transverse members at the same points. Steel tubing is used throughout, and a very light and yet rigid frame results. All joints are brazed, none of the bolts or rivets charactertistic of angle or T-iron frames being present. This construction is costly, of course, but its advantages in the matter of stiffness and superior alignment of bearings need no demonstration.

Two semi-elliptic springs, interposed between the frame and the front axle, carry the weight of the front end of the vehicle, while three of these springs perform this office in the rear. Of the latter, two are longitudinal, and are linked at their front ends to the frame, one on each side, while the third, extending transversely across, beneath the extreme end of frame, is fastened to the frame at its middle point, and is hung at its ends from the rear ends of the longitudinal springs. This system of suspension produces a wonderfully easy-riding vehicle.

As will be seen, all the mechanism is confined within the space bounded by the frame, nothing but the water tank (in the dash) being connected to the body; and therefore the body

which the vehicle is started. The range of movement of the jockey pulley is sufficient to allow for shrinkage and stretching of the belt.

The speed changes are effected by a second hand wheel, just below the first. This wheel is secured to a tube, which carries a spiral pinion at its lower end, which pinion, meshing with another, rotates a longitudinal shaft, which, by bevel pinions, rotates the cam-shaft acting on the gear shifters. Fig. 7 shows this in detail. By the use of the cam-grooved drum the change from high speed to reverse can be made without going through the intermediate speeds.

The speed-changing gears, the differential and the reversing gears are all enclosed in a dust-proof aluminum case, filled with oil. The bearings of these several shafts are of bronze, and lined with antifriction metal, and, in addition to the oil in the case, oil wells and oil rings are provided to make proper lubrication of the bearings absolutely certain.

All the gears are of nickel steel, and those on the differential shaft are cut out of the solid, in one piece with the adjacent half of the differential drum and its sleeve. The makers consider this expen-ive construction justified by the resulting solidity

and lightness. A liberal margin of strength is allowed the gears, but in the event of breakage of the teeth, it is proposed to cut away the toothed rims, leaving the webs, and to rivet new rims to the webs.

The motor, placed horizontally in the front part of the frame, is made in two cylinders for sizes up to 16 h. p., and with four cylinders for higher powers. A centrifugal governor is used,

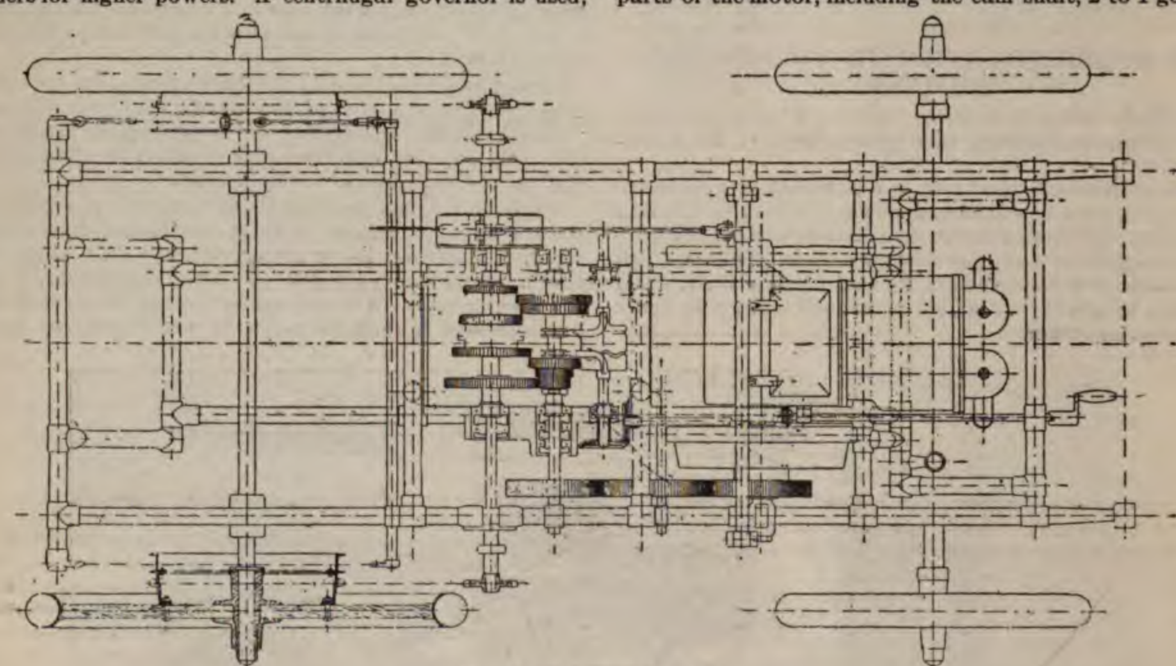


Fig. 2. Plan of Mechanism.

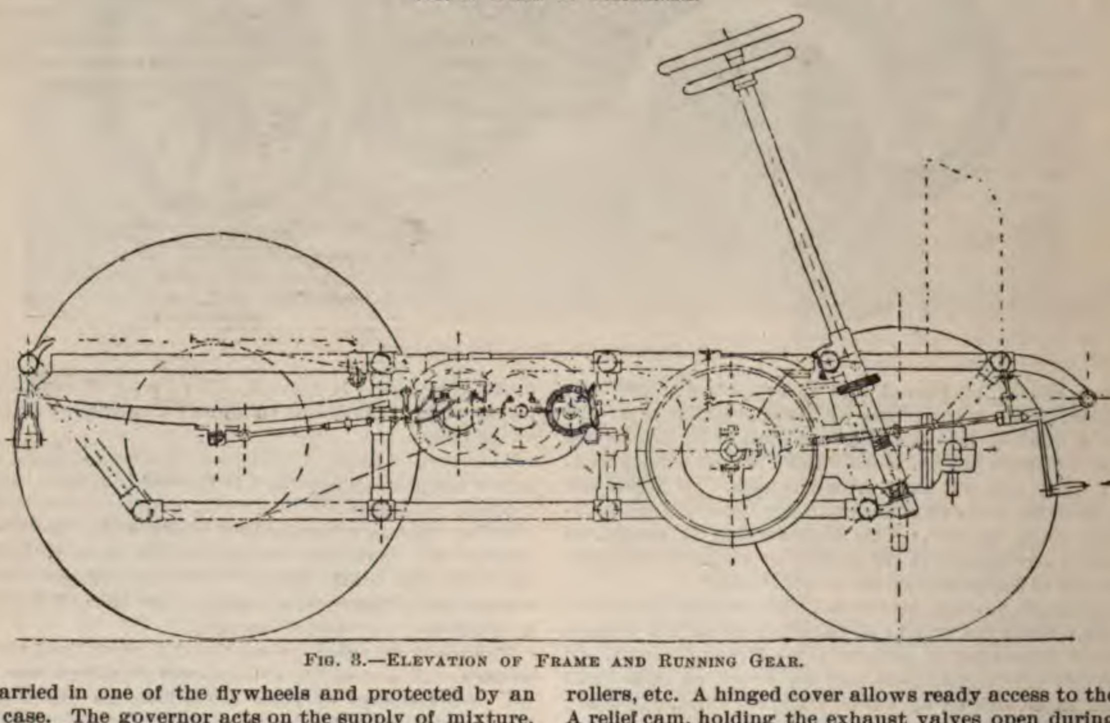


Fig. 3.—Elevation of Frame and Running Gear.

which is carried in one of the flywheels and protected by an aluminum case. The governor acts on the supply of mixture, and an accelerater, located below the steering wheel, allows of throwing the governor progressively out of action, thereby increasing the speed of the vehicle.

Everything about the motor is designed to allow of rapid dismounting and inspection of working parts. The inlet valves are attached to the motor by two straps, held in place by a single bolt, by removing which both the inlet and exhaust valves are exposed. The cooling water enters the jacket at the exhaust valve boxes, thereby keeping these at a very low temperature, so that long trips may be taken without regrinding of valves.

The crank case is dust-proof, and contains all the working parts of the motor, including the cam shaft, 2 to 1 gears and rollers, etc. A hinged cover allows ready access to the interior. A relief cam, holding the exhaust valves open during the first half of the compression stroke, is used instead of the commoner but less satisfactory relief cocks.

The water tank is well provided with radiating tubes, and it is said that a distance of 300 miles may be covered without renewal of the water supply.

From the elevated position of the tank, no pump is necessary,

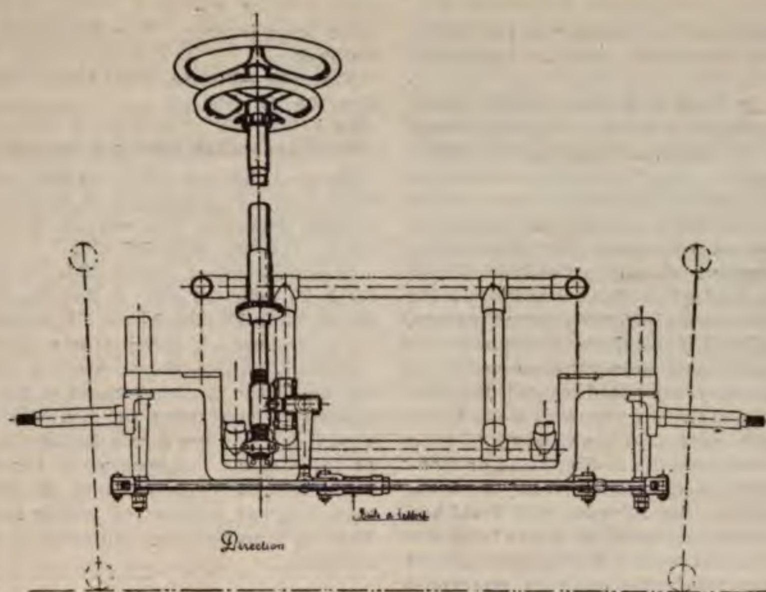



FIG. 4.—FRONT ELEVATION OF STEARING GEAR.

gravity alone being sufficient to maintain the circulation.

The band brakes on the rear wheels are operated by a hand lever at the right-hand side of the operator's seat. The brake

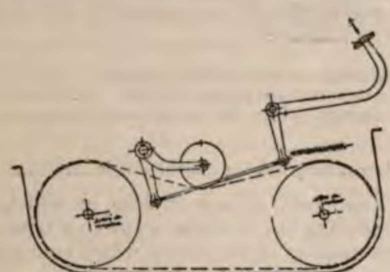


FIG. 5.—BELT TRANSMISSION.

on the differential shaft is controlled by a pedal under the right foot, and is the one principally employed, the other being reserved chiefly for use on long descents. In addition to these, a safety prop provides against danger when hill-climbing.

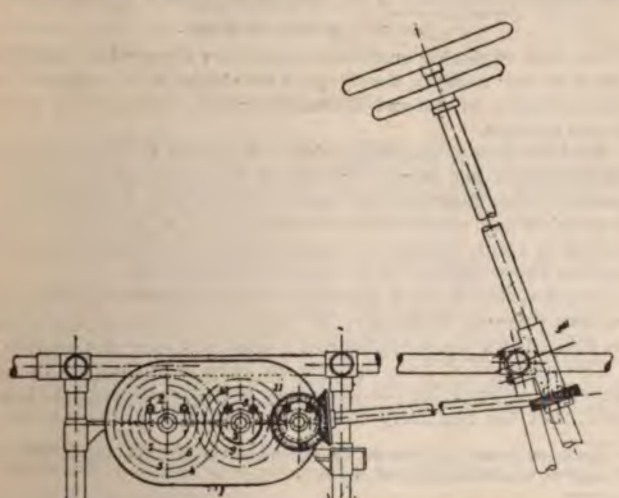


FIG. 6.—CONTROLLING MECHANISM.

## THE PARIS-TOULOUSE RACE.

As in the case of the International Cup event, all the automobile world was kept in suspense up to the last moment as to whether the Paris-Toulouse-Paris *course* would or would not be decided, a proceeding which assuredly renders the holding of such a race infinitely more dangerous than is the case where ample notice is given, and organizers, competitors, and public alike permitted to complete their arrangements leisurely. It was only at 1:30 in the afternoon of Monday, the 23d ultimo, that M. Waldeck-Rousseau, Minister of the Interior, informed M. Jeantaud, the manager of the automobile sections of the Paris Exhibition, that the event might be decided.

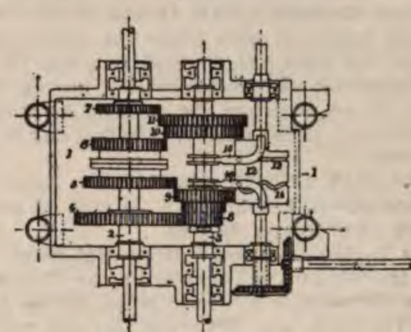


FIG. 7.—SPEED GEARS.

There were three categories, of voitures, voiturettes, and motocycles. The selection of the route gave rise to numerous difficulties, and it was only after several changes that the following was finally decided upon. Starting from Montgeron on the road to Fontainebleau, the *course* led via Melun, Fontainebleau, Montargis, Gien, Bourges, Issoudun, Chateauroux, Limoges, Périgueux, Bergerac, Agen, Castelsarrasin to Toulouse, a distance of 733½ kilomètres (458 miles). Upon the return journey the total of 733½ kilomètres was divided into two stages, the selected halting place being Limoges.

The passage of the racers through the towns was regulated by a cyclist riding before each vehicle, a method which insures the safety of the inhabitants. The event called forth quite an exceptional number of entries, no less than 76, all told, sending in their names.

The starting point, originally fixed at Montgeron, was at the last moment transferred to Lieusaint, some 10 kilomètres nearer to Fontainebleau, with the result that many enthusiasts, who had traveled out by train from Paris to the former place, were there hopelessly stranded, local trains at 2 o'clock in the morning being as rare on the P. L. M. as on most other railway lines. In spite, however, of all the trials and tribulations to get there, some six hundred spectators were congregated together at the railway level crossing at Lieusaint, when, at 3:55 a. m., on Wednesday morning, the 25th ultimo, M. Gaudichard gave the starting signal to René de Knyff, whose big Panhard car was the first of those inscribed on the list of entries. At Gien, 113 kilomètres (70½ miles) from the start, de Knyff was leading Giraud and Hourgières; L. Renault was first in his class and Testé and Gasté were the pioneers of the motor-cycle section. As the day advanced, so did the heat increase, until the blazing rays of the sun began to work havoc among the tires, and without exception the racers had their troubles. At Bourges (178 kilomètres) de Knyff had dropped back into fourth place, Giraud, Voigt and Levegh preceding him. L. Renault still maintained his advance, and Testé had succeeded in gaining 11 minutes on Gasté, who was lying second. Hourgières and Girardot had broken down. The fortunes of the race fluctuated tremendously, for burst or punctured tires were quite the order of the day, and no man was safe to guard his position any length of time. Levegh only experienced punctures—as if they were not enough—and succeeded in augmenting his lead, but the others changed positions continually, as the result of more serious troubles. The order of the leaders at Villeneuve-sur-Lot, 582 kilomètres (364 miles), was as follows:

| | H. | M. | S. | | H. | M. | S. |
|---|---|---|---|---|---|---|---|
| 1. Levegh..........at | 2 | 55 | 11 | 2. de Knyff.......at | 3 | 12 | 53 |
| 3. Pinson...........at | 4 | 20 | 44 | 4. Voigt............at | 4 | 38 | 9 |
| 5. Testé.............at | 4 | 39 | 4 | 6. Giraud..........at | 4 | 40 | 34 |

It was here that de Knyff abandoned the race, as the result of continual punctures. Levegh was never headed, and ultimately pulled up at the finish, some 10 kilomètres outside Toulouse, at 5 h. 18 min. 25 sec., having covered the 721½ kilomètres from Lieusaint in 13 h. 13 min. 25 sec. The crowd had a long and impatient wait before the second man put in an appearance, this being Voigt, whose time was 15 h. 24 min. Giraud next appeared upon the scene, but having taken only 14 h. 58 min. 34 sec. to cover the distance he was classified second before Voigt. The leaders for the first day in each class were as follows:

Voitures:—Levegh, 13 h. 13 min. 25 secs. Ravel, 29 h. 53 min. Voiturettes:—L. Renault, 21 h. 34 min. 55 secs. Motor-cycles:—Testé, 14 h. 40 min. 32 secs.

Hourgières, having a "seized" differential, spent the night at Limoges, traveling on to Toulouse on the Thursday morning. M. Renault ran into a wagon when within a few kilomètres from the finish, and Cottereau also met with an accident, neither racer, however, suffering any injury, but both cars being badly damaged. So ended the first stage, and during the following day the *chauffeurs* were afforded an opportunity of a little repose during the time that their mounts were on exhibition at the Pré-Catelan. The following morning, before a very considerable crowd, M. Huet sent all the racers who had finished the day before, with the addition of Hourgières, on their way, the first to leave at 6:20 a. m. being Levegh, who, however, after traveling a couple of hundred yards, punctured a tire and lost a full quarter of an hour in effecting repairs.

The leaders for the second stage of 351 kilomètres were as follows:—

Voitures:—Voigt, 5 h. 43 min. 49 sec.; Ravel, 6 h. 47 min. Motor-cycles:—Testé, 6 h. 45 min. 55 sec. Voiturettes:—L. Renault, 8 h. 47 min. 1 sec.

At Limoges the local cycle club did the honors during the evening, and at an early hour the following morning all the world was astir to see the racers set out on the last stage of their long journey. The leaders in the final stage were as follows:

Voitures:—Pinson, 6 h. 44 min. 18 sec. Motor-cycles:—Fournier, 8 h. 13 min. 43 sec. Voiturettes:—Renault, 10 h. 4 min. 50 sec.

The final classification for the entire race was:

Cars:—1, Levegh, 26 h. 43 min. 53 sec.; 2, Voigt, 28 h. 2 min. 7 sec.; 3, Pinson, 28 h. 3 min. 16 sec.; 4, Giraud, 28 h. 46 min. 6 sec.; 5, Anthony, 32 h. 38 min.; 6, De Turckheim, 43 h.; 7, Ravel, 46 h. 30 min.

Motor-cycles:—1, Testé, 29 h. 51 min. 53 sec.; 2, Collignon, 33 h. 21 min. 16 sec.; 3, Bardin, 33 h. 48 min. 51 sec.; 4, Gasté, 36 h. 18 min. 51 sec.; 5, Gleizes, 42 h. 9 min.

Voiturettes:—1, Renault, 40 h. 27 min. 40 sec.

From Lieusaint the competing cars were driven by their owners to the Vincennes annex of the Exhibition, for one of the conditions governing the contest was that the competitors should expose their racers during the week following the finish of the *course*. The presence of the cars has proved a distinct attraction at Vincennes, and on Sunday last, in spite of the rain, a great number of people journeyed out by the new Metropolitan Railway expressly to see them.—*The Motor-Car Journal.*

## EXPLOSION MOTORS. *

In the explosion motor, the causes of loss of heat energy are of the same nature as in the steam engine, but they are less, and the energy utilized varies from 15 to 20 per cent. of the total developed by the combustion. If the total number of heat-units of combustion be represented by 100, then the losses will be about as follows:

| | |
|---|---|
| Heat contained in exhaust gases.................... | 27 |
| Heat absorbed by jacket water...................... | 48 |
| Heat dissipated by radiation, etc.................... | 9 |
| | 84 |
| Leaving available for useful work.................. | 16 |

The most important avenue of loss, as will be seen, is the necessity of reducing the cylinder walls to a temperature permitting the lubrication of the piston, which compels us to have recourse to exterior cooling, by air or by water.

The study of a motor of this nature comprises several parts, viz.: (1) the character and formation of the explosive mixture; (2) the mode of ignition; (3) the control of the supply and exhaust ("distribution"), and the utilization of the same as a method of regulating the power; (4) the means employed to keep the cylinder walls at a temperature compatible with the proper lubrication of the rubbing surfaces in the cylinder.

### THE EXPLOSIVE MIXTURE.

The first explosion engines, invented to supply the need for small power units in dwellings and shops, were designed to use a mixture of air and illuminating gas, whence their name of gas engines.

With the idea of enabling industries located in villages where there was no gas supply to benefit from the use of the new motor, which consumed fuel only in proportion to its load and was, so to say, ready at any instant for work, M. Lenoir† conceived, in 1862, the idea of substituting a mixture of hydrocarbon vapor and air for the gas and air mixture.

In possession of such a motor, which could carry with it a sufficient supply of energy, M. Lenoir proposed at that time to utilize it for the propulsion of a boat and also of a vehicle.

The attempt of 1862 appears to have been the first in the direction of applying the explosion motor to mechanical traction; but the relatively considerable weight of the machine,

* Extracts from the address by G. Forestier, at the International Congress of Automobilism of 1900.

†Inventor of the first gas engine, which drew in its charge during the first portion of the outstoke and ignited it at atmospheric pressure, expanding it during the balance of the same stroke.—Ed.

the small number of piston strokes per minute (about 100), and the resulting inadequate speed of the vehicle, prevented that interesting attempt from having any serious influence on automobilism; and its inventor does not seem to have persisted long in that direction.

Gottlieb Daimler appears to have been the real inventor of the hydrocarbon motor, light and fast-running, which has rendered automobilism a practical thing.

The carbureter, whose office is to supply a mixture of one part of vapor to eight or ten of air, is perhaps the most important organ of the hydrocarbon motor. On its uniform operation depends in fact the good or ill performance of the motor. According as the combustion is perfect or imperfect, the cylinder and the exhaust valve will remain clean, or will become fouled and clogged with tarry residuum.

There are many forms of carbureters, all of which are aimed to increase the evaporating surface, in order to favor the mingling of the vapor with the more or less heated air. According to the greater or less volatility of the hydrocarbon used, the saturation of the air may be accomplished at a temperature low or high, the latter of which may be obtained by using the heat of the exhaust gases. Although in stationary explosion motors, notably those employed in agricultural work, illuminating oil (kerosene) is advantageously employed, yet up to the present time "essence," or gasoline, of from 66 to 74 degrees specific gravity and boiling at from 70 to 120 degrees Cent., is used almost exclusively in the explosion motors on vehicles.

In the simpler types of carbureters, of which the de Dion-Bouton is an example, the air drawn by the piston is made to bubble up through the gasoline. This arrangment has the drawback of using the more volatile constituents of the gasoline, the remainder presently becoming too heavy for use. It is then necessary to empty the carbureter and refill it.

To avoid the necessity for constant adjustment of the carburation, it is important that the gasoline should preserve a uniform composition. This is accomplished by substituting the injection of a suitable quantity of the liquid into a stream of air, for the bubbling or surface-evaporation method. Baffles are provided to assist in breaking up the stream of gasoline; and this type is known as the "atomizing" carbureter or vaporizer. The Daimler vaporiser is a good example of this class.

These vaporizers are composed of the following elements: (1) an appliance for governing the supply of gasoline; (2) a tube, by way of which the gasoline enters the air current; (3) a valve controlling the admission of a supply of pure air to dilute with the air which has been saturated with vapor.

The appliance for governing the gasoline supply commonly consists of a chamber in which a float acts on a needle valve, which closes or opens the gasoline inlet. The saturated mixture of vapor and warm air requires, before its introduction into the cylinder, to have added to it a fixed quantity of cold air, about eight or ten volumes of the latter to one of the former, to complete the explosive mixture.

### THE DISTRIBUTION.

For a long time the speed of the engine was governed by acting on the mixture supply, but since 1889 the advantages of controlling by the exhaust have been recognized. Nevertheless, many builders still employ the method of throttling or cutting off the mixture supply.

A centrifugal governor interrupts automatically, when the speed becomes too great, the action of either the inlet or the exhaust valve. If throttling is used, the supply of mixture is less and the explosion pressure is consequently below the normal. On vehicles an apparatus called an accelerator is added to the governor, by which the action of the latter may be temporarily suspended and the motor allowed to exceed its normal speed.

On certain multicylinder motors the governor is arranged to put in action one or two more cylinders, according to the resistance to be overcome.

It is much to be desired that a way could be found of varying the power of gasoline motors, as is done with steam. With the four-cycle motor this desideratum appears to be practically unattainable without some complication of the vaporizer and the air supply. With the two-cycle motor it seems, in theory, to be easier of realization, as the mixture in the former is formed beforehand in a reservoir with variable pressure.

### BALANCING OF EXPLOSION MOTORS.

Vertical explosion motors give to the vehicle, especially when it is standing still, a very disagreeable vibration. This is sometimes overcome by placing the motors horizontally; but many builders prefer the vertical position on account of the better lubrication which it gives the pistons and the lesser liability to wear the cylinders oval. These builders have sought to balance the motors by the use of weights opposite the cranks, similar to those on locomotive drivers and bolted to the cranks. To obtain the best results, these weights should balance not only the weight of the cranks and lower rod ends, but also the pistons.

Other constructors have invented a more attractive solution. Instead of producing the explosions at one end of the cylinder, they burn the mixture in the middle of the cylinder between two pistons moving in opposite directions, in such a wise that the center of gravity of the system remains sensibly fixed. The lower piston acts on a rod and cranks in the ordinary manner. The upper piston carries a rod to which a crosshead is fastened, which actuates two rods, one on each side of the cylinder and connected to cranks on the same shaft. It will be understood that, with this arrangement, equilibrium of the moving parts is obtained only at the sacrifice of lightness and simplicity, and that the motor thus balanced must be more bulky than the ordinary one. Only experience can show whether this ingenious arrangement is justified by its results.

Other constructors employ a similar system, but with horizontal cylinders. In this case the pistons act through links on vertical walking-beams, from the other ends of which connecting-rods extend to diametrically-opposite cranks on one shaft.

## THE AUTOMOBILE CONGRESS IN PARIS.

We are indebted to *The Autocar* for the following extracts from the reports and discussions of the Automobile Congress in Paris.

In his opening address, M. Forestier, Chief Engineer of Roads and Bridges, remarked that, as regarded the steam engine, it had reached such a degree of perfection that it was scarcely necessary to treat it theoretically in a congress, but, nevertheless, it was very desirable to find a means of reducing the volume of the steam generator and the weight of the engine, which problems were just now seriously occupying the attention of manufacturers. In the gasoline motor they knew nothing about the relation between the bore of the cylinder and the area of the explosion chamber, and this was a matter they would have to discuss. Other matters were the suppression of vibration, which was already nearly solved by several carriages shown in the exhibition, the variable running of the internal combustion engine, the systems of transmission, and, what was of still more importance, the capacity of accumulators.

Some makers were now employing accumulators which would allow of cars running from 90 to 120 miles without recharging; but so far as they could judge at present, these performances could only be regarded as a tour de force. It was quite feasible for an electric car to run 90 miles without recharging, but the question arose as to what would be the durability of the battery? During the past year or two companies have been running electric cars in Paris, and their experience, taken in conjunction with the trials carried out by a commission of the Automobile Club, led them to infer that the daily

cost of maintaining a battery would be from four to five francs. They had hoped to have been able to present the members of the congress with an official report upon the accumulator trials carried out last year, but unfortunately the reporter was so busily engaged that he had not been able to get it ready in time.

M. Forestier alluded to the different parts of the autocar and to the improvements which had been made in each, and said that he was pleased to observe the presence of Amedée Bollée and M. Jeantaud, whose inventions in the two distinct branches of the motor-car industry, that is to say, the propelling mechanism and the carriage building, had contributed so much towards the improvement of the motor vehicle. While visiting the exhibition he was obliged to confess that his *amour propre* had received a severe blow in the presence of their foreign rivals. He had observed that in the American bicycles all the parts were interchangeable, so that wherever the bicyclist happened to find himself he could always obtain what he wanted. In the French automobile industry this nterchangeability was entirely wanting, and each car was made up of all sorts of patented parts, with the result that when a *chauffeur* was on tour he found it extremely difficult, if not impossible, to obtain exchange pieces.

All this was a serious impediment to the development of the ndustry, which could only be expected to expand freely when they were able to produce an economical car in which all the parts were easily interchangeable. The Automobile Club de France was trying to do for motor vehicles what the Touring Club had done in securing standard sizes and gauges for bicycles, and if they succeeded in inducing makers to work upon these lines a great deal would be done in smoothing the way of the *chauffeur*. M. Forestier concluded by referring to the difficulties which owners had to contend with over the question of speed and urged that the speed of motor vehicles should be regulated according to the power of the brakes. In other words, it mattered little how fast the machine traveled if it could be brought to a standstill almost instantaneously.

In the absence of Michel Levy, who was prevented from attending by illness, M. Forestier was elected president of the congress, and, in taking office, he regretted the absence of M. Levy, who had done so much to favor the autocar movement in France, and proposed that he should be elected honorary president.

The first three days of the week were to be devoted to the reading of papers and the discussion upon them. Thursday was to be devoted to visits to autocar works, and a general meeting of the congress was to be held on Friday, while the rest of the time would be given up to visits to the autocar section of the exhibition.

The meeting of the first section took place on Monday afternoon at the premises of the Automobile Club. Amedée Bollée presided and presented a report on steam engines and generators. He divided the boilers into four classes, that is to say, the horizontal boiler with a large volume of water of the locomotive type, which was used for portable engines, the boiler with a moderate volume of water of the Field type with vertical tubes, the boiler a caisson with parallel inclined tubes, and boilers of the flash types. Boilers of the locomotive type gave good results in France and England in portable engines where the weight was utilized to secure adhesion. As to the Field type of boilers, such as that used in the Scotte trains, M. Bollée referred the congress to the reports of the heavy car trials. This system, he remarked, had the advantage of being a relatively rapid steam raiser, and of simple and strong build, but t had the inconvenience of a possible clogging up of the tubes, which are liable to burn. The steam, moreover, was not sufficiently dry. The vertical fire-tube boiler was also employed for automobiles, but the steam carried a considerable quantity of water.

This system was employed by M. le Blant, who stated that the production was 3 kilogs. 360 of superheated steam per kilog. of coal* for a generator of 10 square meters of heating surface, working at a maximum of 16 kilogs. per square centimeter. Very little use was made in motor-cars of vertical boilers in which water tubes were inclined from the horizontal, as the circulation of water was not sufficiently rapid to protect the tubes. The same observations applied to annular tubes in coils and bent U tubes.

After speaking of the de Dion boiler, M. Bollée referred to the generator of the Stanley carriage, which, he said, appeared at first sight very attractive on account of its great simplicity. Its inconveniences were the danger of fire from the employment of petroleum spirit as fuel, which also resulted in a high working cost, and the imperfection of the boiler and its feed. Though its volume was so small, it was imprudent to put a boiler of this kind on a carriage on account of the risk the user ran in the feed not acting properly. This danger was enhanced by the difficulty of keeping an eye on the water guage, and it was for this reason that the car was not allowed to run on the public roads in France.

Reference was also made to the flash boilers of the Serpollet type. M. Bollée added that as the generators on motor-cars were so small, it was absolutely indispensable that the feed pump should act perfectly. The simplest and the best of these pumps were those of the plunger type, with valves of big diameter, and running at about 150 revolutions a minute. The stroke should be variable and the transmission gear should be so arranged that the pump could be used during stoppages. An injector was also indispensable. Steam must be superheated, owing to the small dimensions of the boiler and its large production. The superheating tubes ought to be placed either around the inside of the grate or in the chimney or the smoke box, and as they deteriorated very rapidly through being subjected to high temperature and working under pressure, they should be fixed in such a way as to be capable of easy and economic renewal.

The high temperature at the interior of the chimneys of steam cars proved that there was an imperfect utilization of caloric properties, and the waste gases should be absorbed by superheating tubes. The temperature of the superheater could reach 300 to 350 degrees centigrade without affecting the lubrication. When the superheating tubes were placed around the grate they should have a surface of about two and a half times the grate area, and of three and a half times the grate area when placed in the chimney.

(To be continued.)

* This seems absurdly low—only 3 36 lbs. of steam per pound of coal. Perhaps there is an error in the figures as reported.—Ed.

## THE ZEPPELIN DIRIGIBLE BALLOON.

The leading particulars of Count Zeppelin's dirigible or steerable balloon, which has been building on a raft on Lake Constance, and which was given a partly successful test on July 2, are given as follows in our French contemporaries:

The balloon has a cigar-shaped aluminum framework, and is covered with a special cotton fabric, made impermeable with gutta-percha. It is divided into 17 compartments, any of which will hold gas if the adjacent ones collapse. Its length is stated to be 416 feet, and its diameter 38 feet. There are two cars, one at the front and the other at the rear end, and each car carries a 15-h. p. Daimler motor weighing 430 pounds, driving a four-bladed aluminum screw. A weight of 55 pounds is arranged to slide on a rod under the balloon, to shift the center of gravity. By this means the balloon is pointed upward or downward as desired.

The test, which was brought to an end by the rope working the ballast-weight becoming entangled with a steering rope, was satisfactory so far as the ascending and descending went, but it showed that the motive power was insufficient to render the balloon really "dirigible." Instead of the promised 32 feet per second, the speed attained was only 26 feet.

## MINOR MENTION

Flagstaff, Ariz., is to have a motor vehicle line.

The Feister Engineering Co., of Wilmington, Del., has been incorporated to manufacture and sell "automatic coaches."

An electrical contemporary informs its readers that "the Stanley Automobile Co. will manufacture automobile patents" in New York City.

The New Haven, Conn., Electric Cab Co., which has started a line of electric 'buses on Orange street, is talking of adding a line to the Yale Field.

Dr. E. P. Clarke, of Utica, N. Y., has had constructed a motor bicycle according to his own ideas. The motor is over the rear wheel, and is said to weigh only 17 pounds.

We have received from the Aurora Automatic Machinery Co., Aurora, Ill., an interesting pamphlet of advance sheets showing the new "Thor" roller bearings as applied to vehicle wheels.

The Houghton Automobile Co., West Newton, Mass., which was organized last October, was incorporated last month under the laws of New Jersey, with an authorized capital of $250,000.

A Scranton, Pa., man, P. J. Collins, has invented a new style electric carriage, and a company is being formed to manufacture it in Scranton and put it on the market. A test has proven satisfactory.

Owing to its level grades, Buffalo is said to have more motor carriages than any other city of its size in the United States. About 70 is the estimated number of these vehicles there, including electric cabs.

There will be a motor vehicle race from Philadelphia to Trenton, N. J., and another from New York to the same city, on September 22, under the auspices of the Inter-State Fair. Cups are offered for each event.

Two almost simultaneous reports have come to hand via the press. One announces that two electric cab companies will soon be running vehicles in Denver, and the other tells of the collapse of the electric cab service in Worcester, Mass., on account of its high cost.

The Pullen Storage Battery Company, of Camden, N. J., has preliminary drawings under way for an immense brick and iron automobile manufactory to be erected in that city. The company will spend a large amount of money in equipping the plant.

All the space has been rented for the coming exhibition in Madison Square Garden, November 3 to 10, and the applications ungranted are still so numerous that the Automobile Club of America is in a quandary as to how they can be accommodated.

Steps have been taken looking to the establishment of a motocycle club in Boston. Among those interested are Kenneth Skinner, Chas. H. Metz, of Waltham, and Edw. Hayes, of Providence. A meeting to perfect the organization will be held August 22, and on the following Saturday the club will hold a run to Newport.

The Waltham Mfg. Co. has brought out a motor bicycle, fitted with the Aster motor in a range of sizes from 1¾ to 3¼ h. p. On July 31 Albert Champion gave an exhibition performance with a 3¼-h. p. machine on a banked track at Boston. He covered a mile in 1:26⅗, and five miles in 7:16⅗. We shall publish a photograph of one of these machines next week.

The automobile is to be turned to practical account by the farmers of Kent, Eng. Every year a large part of the fruit crop rots for lack of transportation, the railways not being able to meet the emergency, and the plan is for the farmers next year to take things into their own hands, starting motor cars round the orchards during the evening and night and bringing the day's pickings to London by the early morning.

The Remington Automobile & Motor Co. has been incorporated under the laws of New Jersey with capital stock $250,000, to manufacture and sell motor vehicles of every description, also launches. The place of business in New York State will be Ilion, N. Y., where it is contemplated shortly to operate a large manufacturing establishment, which at the outset will employ from 200 to 300 hands. The officers of the company are: President, Philo E. Remington; vice-president, to be elected; treasurer, S. C. Burch; secretary, P. A. Stubblebein.

## TESTS OF FRENCH VEHICLES.

Our contemporary, *La Locomotion Automobile*, has gathered into one volume the results of the tests of motors and vehicles carried out under its auspices from October, 1899, to January 1900, together with all the illustrations which accompanied the original publication of these articles. Under the title "Le Concours de Moteurs," this volume records tests of de Dion, "Minerve," Hurtu, Amiot-Peneau, Dumas fils, Delahaye, Panhard-Levassor, and many other machines of leading makes. In the case of the motors the cylinder and valve dimensions are given, and this should make the book very valuable in checking calculations on the power of similar motors. The book is sold at a price of three francs, and is, of course, all in French.

## AT NICE.

If any proof were needed, the recent chase and capture by the Mayor of Nice of a law-breaking motor cyclist should conclusively demonstrate to those reckless *chauffeurs*, who delight to terrorize the public that Monsieur Sauvan is not a gentleman to be trifled with, and that the sooner they relinquish their foolhardy and selfish conduct the better it will be for them. The incident in question occurred about 6 o'clock on the evening of Tuesday, the 10th instant, a time of day when the far-famed Promenade des Anglais is crowded to excess. Tranquilly seated in his carriage, M. Sauvan was chatting with some friends when his attention was directed to a motor cyclist issuing from the public gardens at a tremendous rate of speed. Heedless of the cries of the passers-by, and the appeals of the police, regardless even of the Mayor's orders to stop, the *chauffeur* raced by like a flash of lightening, leaving frightened people and terrorized horses in his train. But his just retribution was to come, for M. Sauvan promptly gave chase, and followed him down a *cul-de-sac*, which he had entered blissfully unconscious of the nearness, or even of the existence of the pursuit. Placing his carriage right across the road, the Mayor effectively blocked the sole means of exit, and the culprit having been secured, a summons was promptly taken out against him, which will assuredly be followed by the severest sentence that M. Sauvan can pass upon him. It is truly disgraceful that any motor-men should so far forget the good-feeling and benevolence hitherto displayed by the Nice authorities toward local automobilism as to commit such outrages, and it is indeed a pity that these *chauffeurs* cannot be singled out and severely punished without making the whole automobile community to suffer by the framing of more rigid regulations. I undertand that M. Gondoin, the president of the "A. C. N.," has already notified the authorities of some of these motor-men who so abuse the police regulations, and the Club can be depended upon to lend hearty co-operation in putting a stop to this evil.—*The Motor-Car Journal.*

## THE TRANSMISSION GEARING OF THE ST. LOUIS AUTOMOBILE AND SUPPLY CO.

The outline drawing shown herewith (Fig. 1) indicates the general arrangement of the running gear and mechanism of the "Outfit No. 1," put on the market by the St. Louis Automobile & Supply Co., 23d and St. Charles street, St. Louis, Mo. This includes a complete running gear, with wood wheels, ¼-inch solid rubber tires, angle iron frame, mounted on loops, motor and transmission. The motor is a single cylinder 5 x 6-inch gasoline engine, with shifting igniter. Only one friction clutch is used, this being on the engine shaft.

Figs. 2 and 3 show the transmission gear detached. A spur pinion on the engine shaft meshes with a rawhide gear (not shown) on the upper shaft carrying the two shifting pinions (Fig. 2). In the half-tone this shaft is shown with a sprocket pinion on it, by means of which chain connection to the engine shaft may be used if preferred. The makers, however, recommend the gears as above mentioned. The shorter of the two hand-levers shifts the two pinions on this shaft, giving two forward speeds. Back of this upper shaft is seen another, which carries two pinions and also, at its outer end, a brake drum. This is seen best in Fig. 3.

Reversing is accomplished by bringing the smaller of the shifting pinions into mesh with the pinion on the brake shaft nearest the brake drum. To accomplish this we judge that there is an interval between the two shifting pinions, allowing the smaller one to over-run the larger gear on the shaft below, and that the other pinion on the brake shaft is in constant mesh with the other gear on the lower shaft. This lower shaft carries the sprocket pinion, from which a chain runs to the differential on the rear axle, as seen in Fig. 1.

FIG. 2.

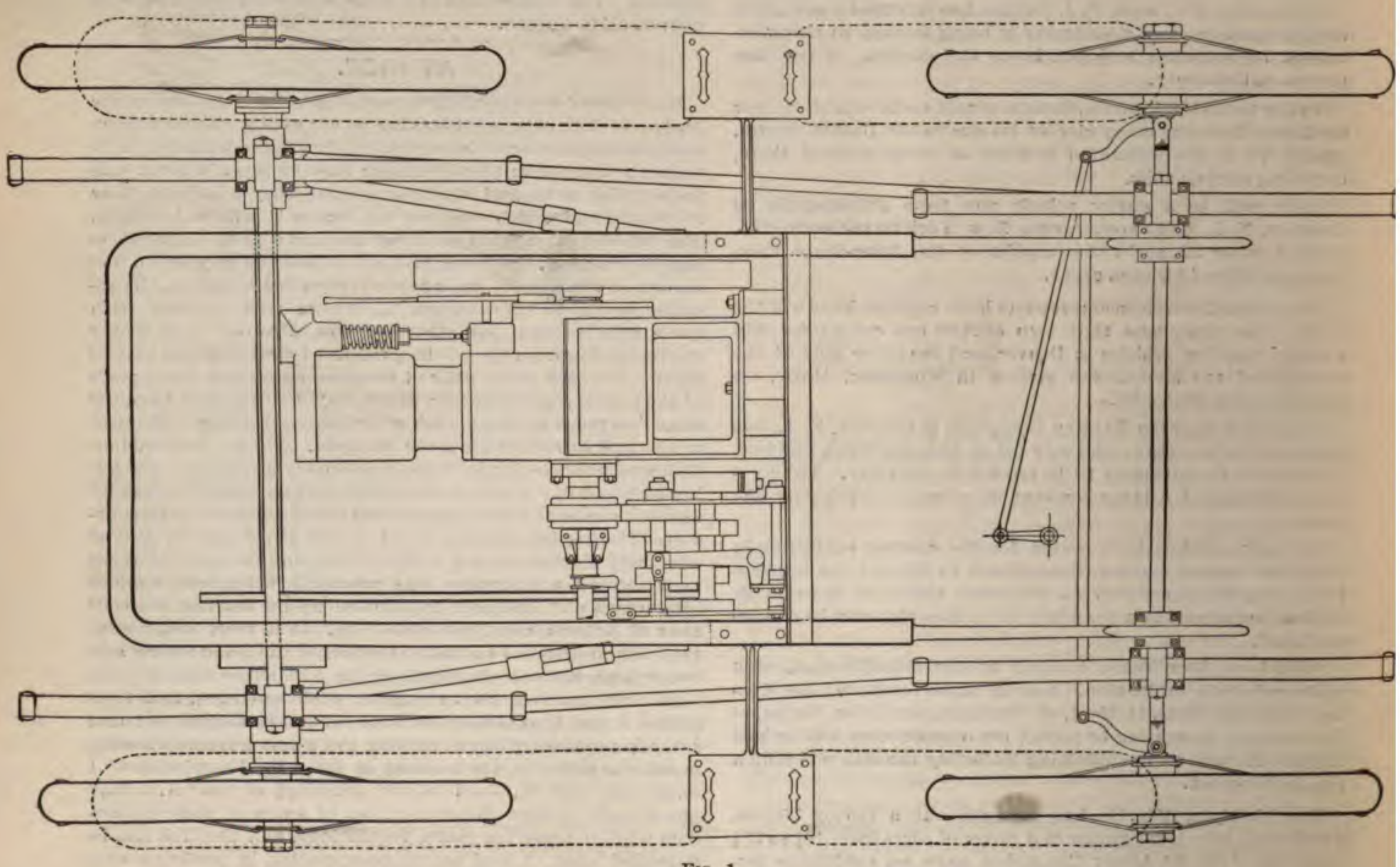


FIG. 1.

FIG. 3.

The longer hand lever has connected to it, about two-thirds of its length down from the handle, a link operating on the friction clutch on the engine shaft. Short movements of this lever operate the clutch, and a further movement applies the brake shoe seen in Fig. 3. The levers are so connected that the speed-changing gears cannot be shifted till the clutch is disengaged.

FIG. 4.

Fig. 4 shows an outfit just put out, with pneumatic instead of solid tires and with a double-cylinder 7-h. p. engine The company will change wheel base, track, sizes of wheels and tires, etc., to suit the purchaser.

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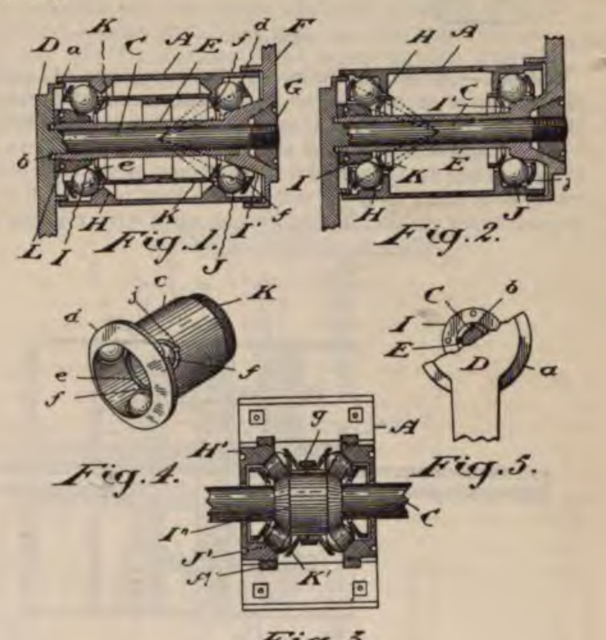
A point made in favor of automobiles is that they do not defile the streets. Their common use would greatly reduce the cost of street cleaning. A Chicago newspaper, touching on this point, suggests that the time may come, in a not distant future, when cities may require a license for the privilege of using a horse in the streets, so as to require owners of horses to pay the expense which their use imposes on the public.

# MOTOR VEHICLE PATENTS ∴ ∴ OF THE WORLD ∴ ∴

## UNITED STATES PATENTS.

654,179—Roller Bearing.—A. W. Ponton, of Ottawa, Can. July 24, 1900. Application filed August 8, 1899.

The purpose in this system of ball and roller bearings is to eliminate rubbing friction of the balls, by so forming the cups and cones that the balls will act like conical rollers. Fig. 1 shows a two-point bearing constructed on this plan. It will be noted that the cups and cones are conical and having different angles of slope, such that elements of both will intersect at a point in the axis of rotation. The balls could, therefore, be replaced by small cones, and either balls or cones will roll in a true circular path in a plane perpendicular to the axis of rotation of the wheel. The balls have small gudgeons formed on them, which slip into grooves in retaining rings K and are journaled therein, the gudgeons being in line with the axis on which the ball turns. In a two-point bearing the balls tend to slip or work outward, owing to the pressure on them, and in this form of bearing the outer retaining rings are connected to the inner ones, and both pairs together, so as to overcome this tendency.




654,179.

Fig. 2 shows a three-point bearing, in which it will be seen that the two outer bearings of the cup are both in a line or element intersecting an element of the inner cone in the axis of the wheel's rotation. Fig. 3 shows the principle applied to conical rollers.

654,356—Gas or Petroleum Motor.—Jean Rambaud, of Lyons, France. July 24, 1900. Application filed July 6, 1899.

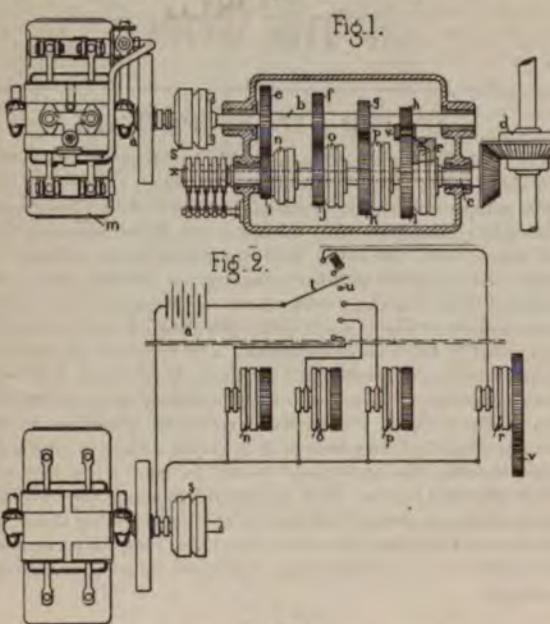
An air-cooled six-cycle motor, in which the scavenging stroke is depended on to assist in cooling the cylinder.

654,478—Motor Cycle.—J. H. Munson, of Chicago, Ill. July 24, 1900. Application filed May 16, 1898.

An elaborate detail patent on a "combination" vehicle with explosion motor and auxiliary electric equipment.

654,632—Gear for Motor-Cars.—J. J. Heilmann, of Paris, France. July 31, 1900. Application filed Dec. 19, 1899.

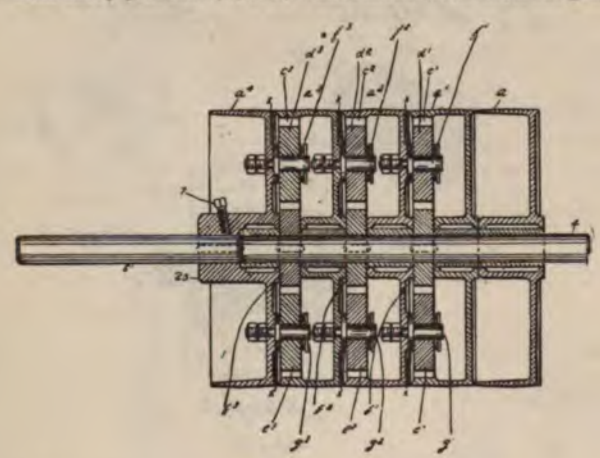
A system of magnetic clutches for the speed-changing gears. The diagrams show the arrangement clearly.




654,632.

654,681—Differential Pulley.—C. E. Scrimgeour, of Lewiston, Me., assignor of one-half to W. B. Hammond, of Cambridge, Mass. July 31, 1900. Application filed October 7, 1899.

In the figure, 4 is a fixed shaft, on which the pulleys a, $a^1$, $a^2$, $a^3$ are free to turn, and 6 is the driven shaft, to which the pulley $a^4$ is made fast. It will be seen that pulleys $a^2$, $a^3$, and $a^4$ each carry pinions e, f, etc., which mesh with internal gears



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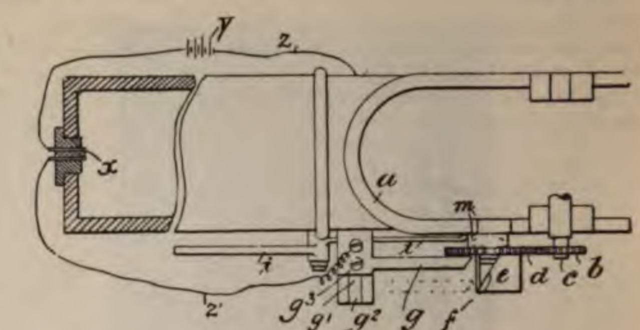
on the adjacent pulleys and also with pinions $b^1$, $b^2$, $b^3$ keyed to the fixed shaft 4. If, therefore, the driving belt is on pulley $a^3$, the speed is reduced once between that pulley and the shaft 6. If the belt is on pulley $a^2$, two speed reductions take place, and if it is on $a^1$, the speed is thrice reduced; each successive pulley driving the one to the left of it at a speed lower than its own.

654,693—Electrical Igniter for Hydrocarbon Engines.—Hugo Weglin, of Augsburg, Germany. July 31, 1900. Application filed February 16, 1899.

The leading feature of this invention is the method used to



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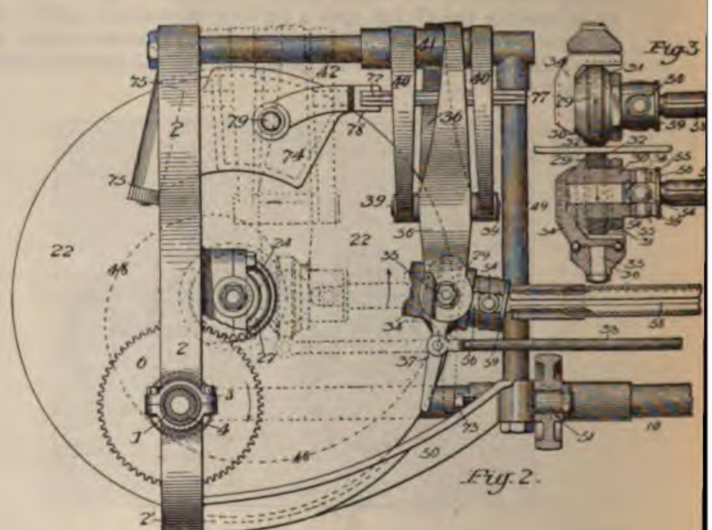
vary the moment of ignition. The circuit-breaker has a beveled edge f, and the brush g, being shifted laterally along the tongued groove $g^2$, leaves the edge of the circuit-breaker earlier or later, according to its position.

654,716—Motor Vehicle.—Edw. P. Cowles, of Warren, Ohio. July 31, 1900. Application filed August 25, 1899.

This invention comprises a complete and highly meritorious scheme of transmission from motor to axle, with braking and controlling devices. It may be used with any kind of motor, but is particularly adapted for use with explosion motors.

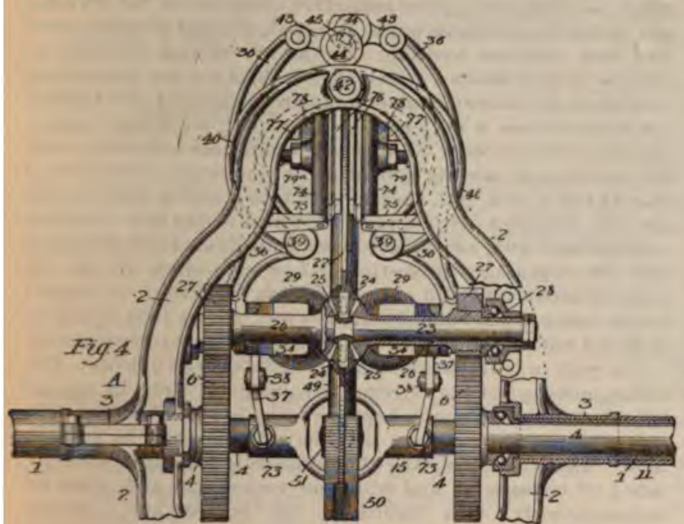
Fig. 1 shows a plan view of the transmission mechanism and running gear. The reaches are connected to the front axle, and to the tubes 1 inclosing the rear driving-axles, by bearing T's 11 and 14, which are loose on the members which they connect, and on which they are prevented from slipping lengthwise by suitable collars, as 12, 13. The frame is thus made flexible The driving-axle 4 (Fig. 4) is divided into two parts, and the inner end of each carries a gear 6 6, which gears are driven by pinions 27 on the ends of a short differential shaft 23. A suitable yoke 2 connects the inner ends of the tubes 1 1.




654,716.

The differential is driven by a thin steel disk 22, about 16 or 18 inches in diameter, which is made fast on the pinion-carrying ring 24. This disk receives the power from the two friction rollers 29 (Figs. 2 and 3), of indurated fibre or other friction material, which are forcibly pressed together, one on each side of the disk, by suitable levers to be described. These friction rollers, whose axes are normally parallel to a radius of the disk, are connected by universal joints to telescopic shafts 53, having other universal joints 64 at their forward ends, and being pinion-geared together at 60, so as to receive power equally from the motor. By means of toothed clutches, in con-

nection with suitable disengaging and shifting mechanisms, all of which are described in detail in the specifications, either one or the other shaft may be driven by the motor; and in this way the direction of rotation of the disk and axle may be reversed.



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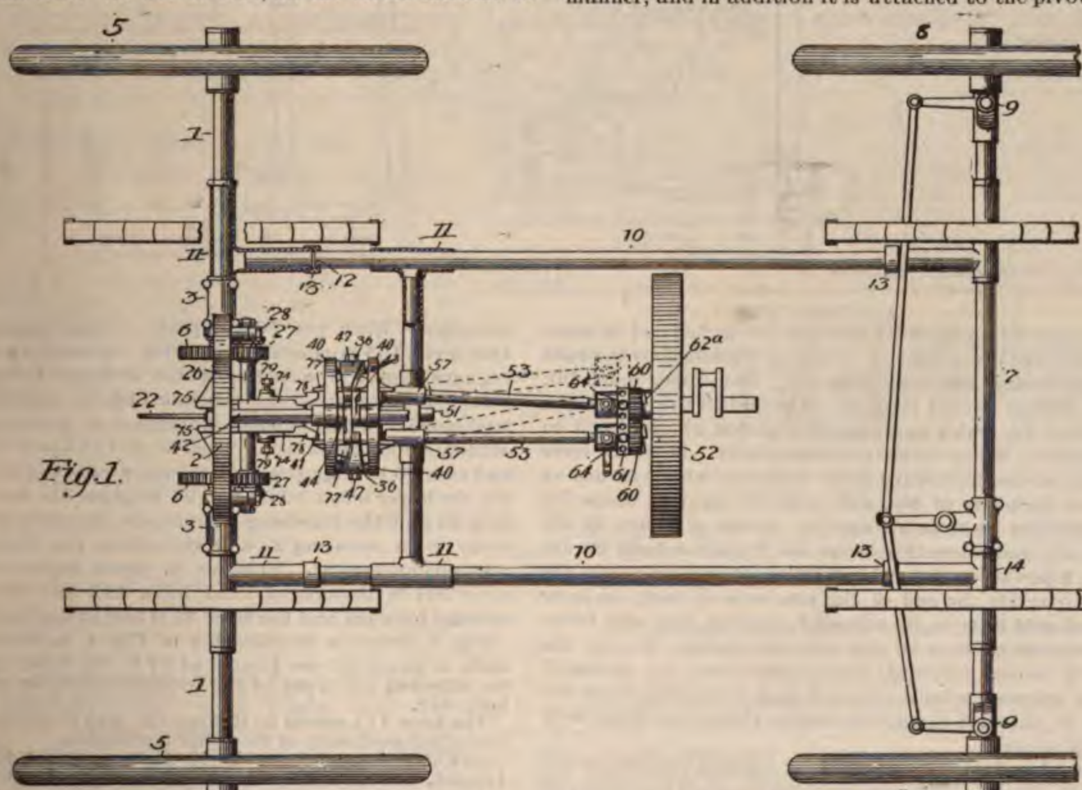
As seen in Fig. 3, the friction rollers 29 are mounted in carriers 34, which are hung from levers 36, pivoted at 39 to the arms of yokes 40. These yokes are hung from a sleeve 41, which is free to slide on a horizontal fixed rod 42. By means of toggle links 43 and eccentrics 44, on a shaft (not shown) above and parallel with 42, the upper ends of levers 36 are spread, and the lower ends carrying the friction rollers are caused to approach the disk. As will be seen, all the forces incident to this gripping arrangement are self-contained, and no strains are thrown thereby on other parts.

To brake the vehicle, two wings, 74, faced with friction material, are pivoted at 75, and are closed on the disk by the upper arms of levers, 36, when the latter are moved to release the friction rollers. To render the application of the brakes independent of the position of the yokes 40 and sleeve 41 (which, as will presently be explained, shift along on rod 42), arms 77 are carried by the levers 36, which arms are long enough to act on the brakes at 78 in any position of 41.

Changes in speed are effected by traversing the friction rollers 29 towards or away from the center of the disk. This traversing is accomplished with little effort by slanting the axes of the rollers, as shown in Fig. 2, so that they will tend to move thus of themselves when running. When the disk is in the forward motion, its direction of rotation will be backwards, as indicated by the arrow. The rollers are slanted or tilted by the link 38, acting on the arm 37, projecting downwards from the piece 34. If then the link 38 be pushed backwards, as shown in Fig. 2, the rollers will start to traverse backward, carrying with them the levers 36, the link 38, and the yokes and sleeve 40, 41; and they will continue this movement so long as the operator continues to push backward on the link, or until the limit of movement is reached. When the backward movement of the link is arrested, the rollers automatically return to their normal position. A stop, 73, is provided at the end of the outward or slow-speed movement.

It will be seen that if the direction of rotation be reversed, the rollers will not follow the link, but will tend to move in the contrary direction, so that variation of speed would be difficult or impossible to accomplish when backing. It is, therefore, proposed to use only the slowest speed when backing, and the controlling mechanism provides for the return of the rollers to their outer position before reversing takes place.

The general arrangement of the controlling devices is shown in Fig. 10. The upright, 80, is used for steering in the usual manner, and in addition it is attached to the pivot 83 by flexi-



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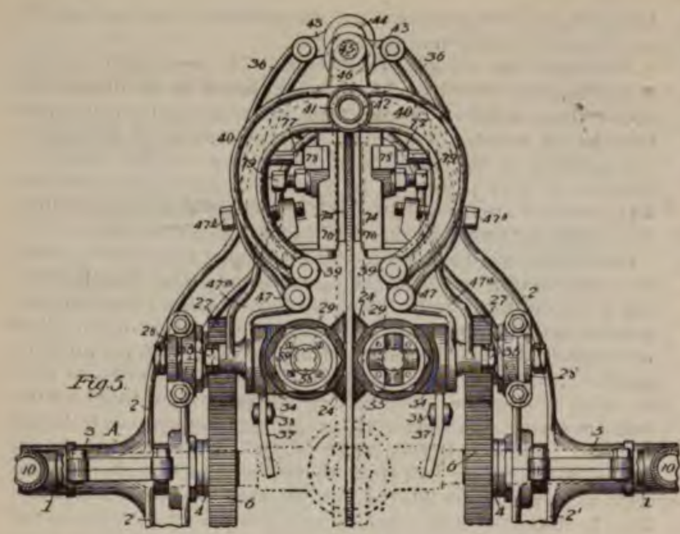


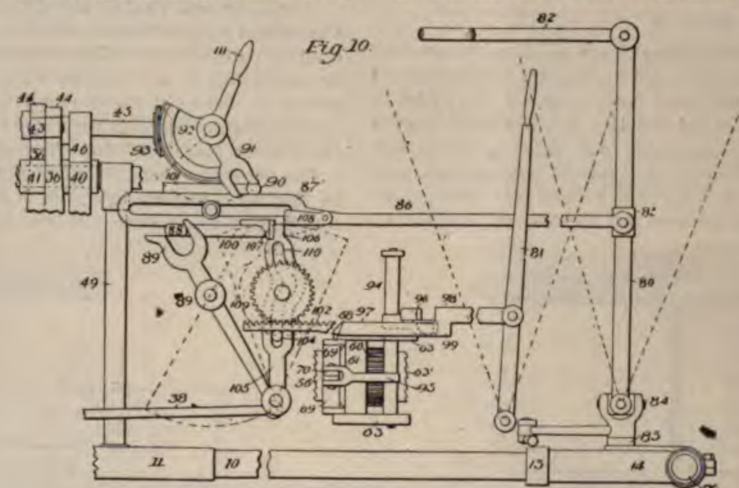

654,716.

ble joint 84, permitting it to swing backward and forward, beside turning steering-joint 84. Near the center of 80 is attached a horizontal rod 86, working a sliding cam-block 87.

fork 96, turning rock-shaft 94 and its lower arm 95, reversing the motion of the friction-wheels 29. In the return movement of 81 the lower offset 99 of bar 97 engages the lower prong of fork 96, and the movement is reversed.

It will be observed that the forks 89, 91, and 96 have prongs offset, so that when their respective cams 88, 90, 98, 99 pass the point the straight parts 100, 101, 98, and 99 slide over and lock them in position. As the movements of friction-wheels 29 and brake 74 necessary in backing are effected by cam-block 87, instead of putting in an extra set of mechanism for this purpose a device is used that automatically couples bar 97 with cam-block 87 and performs these functions with the mechanism already provided. A backward extension of bar 97 has a rack 102, that meshes into a pinion 103, having an arm provided with a pin 104, which works in a slot in a vertical lever 105, having its lower end pivoted and its upper end 106 engaging a projection 107 on cam-block 87. In its forward movement 106 engages a latch 108, which is tripped at the point where cam 88 strikes fork 89, so that block 87 does not follow 105 in the remainder of its forward movement.

The cycle of movements of reversing-lever is as follows: The initial movement from extreme forward point 106 will engage 87 at any point where it happens to be left and traverse friction-wheels 29 to extreme periphery of disk and lock them here. When cam 90 strikes 91 and slightly releases wheels 29, offset 98 engages 96 and reversing commences and goes on simultaneously with tightening the brakes, etc., already




654,716.

The lower cam 88 on block 87 engages the forked end of rocking lever 89, the lower end of which is attached to the rods 38, for traversing friction-wheels 29. The upper cam, 90, engages a similar forked lever, 91, attached to the segment of a bevel-wheel 92, which meshes with a pinion 93, attached to square shaft 45, which turns the eccentrics 44. When the lever 80 has been moved backward so far that the wheels 29 are at the extreme periphery of disk and arms 37 against stops 73, cam 90 engages fork on 91, and by means of gears 92 93, eccentrics 44, and operating-levers 36, friction-wheels 29 are released. A farther backward movement of lever 80 causes the cam 88 to override the end of the rear arm of fork on lever 89 and lock said lever in its adjusted position, and this backward movement of lever 80 also sets the brakes. If now the lever 80 is moved forward, these operations are reversed, brakes are released, wheels clamped, and traversing from the periphery of the disk toward the center thereof or from slow to fast commences.

The reversing device is operated by upright rock-shaft 94, through the arm 95. The upper arm 96 is forked like levers 91 and 89. Pivoted to reversing-lever 81 is a horizontal slide-bar 97. This bar has an offset at 98, which engages one prong of

described. When pin 104 of pinion 103 reaches the position 109, lever 105 commences to swing forward, and point 106 engages latch 108, releasing brakes and tightening wheels 29. When pin 104 reaches the position 110, the machine is moving backward. In the forward movement of lever 81 the motion of pinion 103 is reversed. When lever 105 has moved block 87 and cam 90 to engage 91 and release pressure of friction-wheels 29, the lower offset 99 on bar 97 engages the lower prong of fork 96 and the reversing commences and goes on simultaneously with releasing 29 and tightening the brakes, as in the previous movement. When pin on pinion reaches position 104, lever 105 is disengaged from latch 108 and the machine is moving forward and the lever 82 is free to traverse wheels 29.

Fig. 5 shows a modification of Fig. 4, in which the lower ends of levers 36 are jointed at 47 to the upper ends, and can be adjusted for wear of the friction rollers by means of the bolt 47[a].

The lever 111 serves to tighten the grip of friction-wheels or brake independently of the other mechanism.

654,797—Motor Vehicle.—H. J. Lawson, of London, Eng. July 31, 1900. Application filed March 28, 1900.

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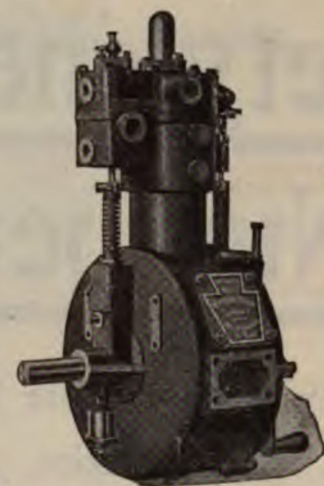

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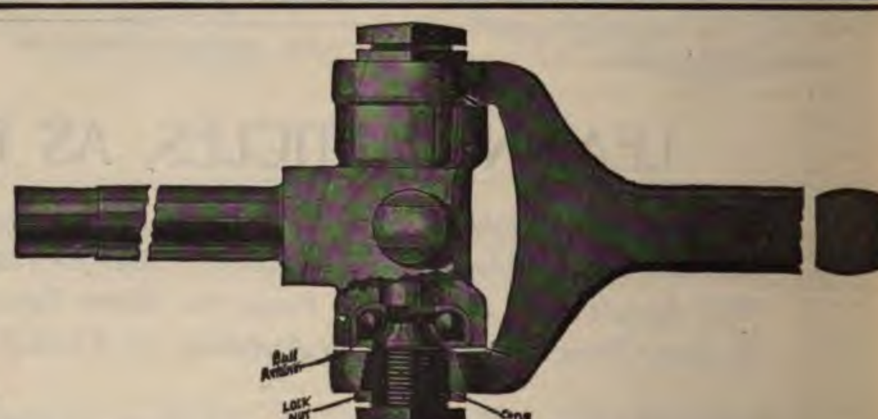


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VOLUME VI NEW YORK, AUGUST 22, 1900 NUMBER 21



## THE HORSELESS AGE.

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## IS THE FIRE-TUBE CARRIAGE BOILER DANGEROUS?

THE criticisms which have been made in England and on the Continent regarding the design and safety of the small fire-tube boilers used in steam carriages on the Stanley lines do not impress us as being very weighty. On page 22 of our last issue was quoted the opinion expressed by Amedée Bollée at the recent Automobile Congress, to the effect that it was imprudent to put a boiler of this kind on a carriage on account of the risk the user ran if the feed did not act properly—a danger alleged to be enhanced by the difficulty of keeping an eye on the water gauge. As it is on account of the supposed danger from low water that boilers of this class are not permitted on the public roads in France, the objection calls for serious consideration even if it does not command assent.

As a matter of fact, it is only a question of money, material and design to build any sort of a boiler to withstand any given conditions. If for whatever reason it is desirable to have a boiler that will run dry without exploding, and if the need for it is such as to justify the cost of making it, there is no reason in physics or engineering why it cannot be done. What makes the cylindrical boilers of the ordinary designs—Scotch, Lancashire, etc.—so dangerous, in the event of low water, is that they have crown sheets or flues, which, if suffered to become red-hot, will collapse, tearing open a seam and causing rupture of the boiler. The water is not expected to get low in these boilers, and no provision (other than safety plugs) is made for such an occurrence. The Stanley and similar boilers, on the other hand, have neither flues nor crown sheets, properly so called. They are simple cylinders, with small tubes extending from end to end and expanded into the heads. There is, therefore, nothing to collapse, even if the whole boiler were made red-hot. As to bursting, the expense of making the factor of safety double or treble what it is in larger boilers is so small that it may be and is ignored; and this provides—not so much for undue pressures, which are prevented by the safety-valve—but for deterioration in service.

This, of course, is not to say that the Stanley type of boiler can be run dry with impunity. On the contrary, it is, after such an experience, if not actually ruined, at least a very promising candidate for the hospital. The overheating and the unequal expansion thus induced cause the tubes, some or many of them, to leak at the ends. This relieves the pressure and prevents casualities, but it puts the boiler out of service till the tubes are made tight once more. In this connection the experiment made a few months ago, by the makers of one of these boilers, is worth remembering. They put a boiler, with water in it, over a fire in an excavation in the ground. All valves were closed, and a pipe was led off to a distance, where a steam gauge was connected. The pressure shown by the gauge rose to 1,200 pounds, at which it stopped. At this pressure the joints between the tubes and the sheets began to open, and the steam gradually escaped till the water was exhausted.

A perhaps more important objection, which might have been raised by our European critics, is the possibility of deterioration by grooving, pitting, electrolytic action between the steel and copper where two metals are employed, and kindred ailments, common enough and discoverable by inspection in large boilers, but which can only be guessed at in the small ones. Very likely that was what Sir David Salomons had in mind when he objected to these boilers on the ground that their interiors are inaccessible. Grooving might take place at the bend where the tube sheets are flanged, if the bend were made too sharp, especially if copper tubes were used with a steel shell; or it might conceivably occur at the longitudinal

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slight draft from the parting line out, as clearly shown in Figs. 30 and 31. In the bronze rod pattern one-half the crank-pin brass is made solid with the pattern, and the semicircle in this end, as also the hole in the wrist-pin end, must be made enough smaller than the crank-pin and wrist-pin, respectively, to allow of boring to size. In the steel rod, allowance must be made in the designing, for the bronze bushing, which need not be over 1/8-inch thick for engines up to 6 or 8 h. p.

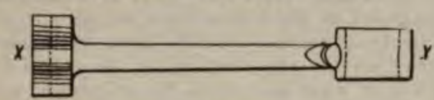
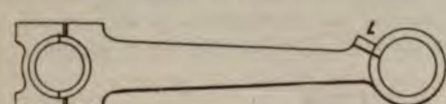



FIG. 31.




In both forms of rod the brasses are adjustable for wear. In the wrist-pin end this is done by splitting the casing, after having drilled and tapped the lug L for a tightening screw. In the crank end, the inner edges are to be milled or planed as shown in Fig. 32, and when adjustment is required, by slightly filing the edges BB, very fine adjustment may be had.

For the body of the pattern use stuff one-half the thickness the web is to be. Mark upon it the outline of the rod and saw out, giving the necessary draft. Mark a second one from this and saw also, being careful to give it draft in the same relative direction as the first half; that is, if in marking it out from the first half, the larger side or the side next the parting-line is used as the guide, then the marked side upon the second half must be made the larger side also. It is advisable to leave intact the parts where the crank and wrist-pin casings are to go, until these casings are glued into place and then to saw out all together, which insures better alignment and a smoother casting. Before fastening the casings to the body pieces, these latter should be placed together in position, and two half-inch brads driven into them near the ends to hold them while they are sandpapered, the edges rounded, and the holes drilled through one and into the other for the reception of the dowel-pins. The ends forming the casings are best turned to correct outside dimensions, and after gluing into place, the holes and the semicircles as described with the compasses and sawed.

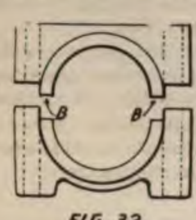



FIG. 32.

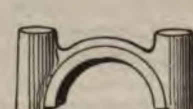


FIG. 33.

It will be understood that the crank end of the pattern for the steel rod will be made flat as shown, and of the same size and outline as shown in Fig. 30 in the bottom view of the base. Its thickness will be governed by the size of the motor, and will run from 3/16 inch in the small sizes to 1/2 inch or 5/8 inch in larger motors.

The pattern is now ready for the lug to carry the stud-bolt for adjusting the wrist-pin brass, and, in the case of the bronze rod, the lugs for the bolts by which the crank brass cap is held to the base. These lugs are best formed by turning pieces to the required diameter for the body of the lug and then sawing lengthwise from the centre a piece about as thick as the web of the rod. The two outside pieces remaining, when glued into place and the edges trimmed and sandpapered, will form the required body through which to drill for the bolts in the finished rod. The pattern for the cap, for either style of rod, may be made by turning a piece the correct size and shape for the outside of the cap, allowing 3/16 inch in length over the finished length for machining. If turned from a glued piece as for a split pattern, the piece may now be split and the semicircle either sawed out or worked out with a gouge, the inside diameter being about 1/8 inch less than that of the crank-pin, to admit of boring to size. The lugs for the cap may be turned to size with slight draft in their length, and sawed to fit the cap, as in Fig. 33. If the bronze base is to be used, it is made in the same manner as the cap, except that the part constituting the base should be extended straight across between the lugs to form a bearing for the flat end of the steel rod.

Wax all sharp corners, and this pattern is ready for the shellac.

### PATTERN FOR THE CRANK SHAFT.

In entering upon the description of this pattern, it is assumed that the more expensive forged shaft is to be dispensed with, and that a steel casting is to be employed. It is now possible to secure excellent castings in high-grade steel, comparatively free from blow-holes or serious defects, from a half dozen concerns doing business in this country. The writer has experienced much trouble, however, in securing sound castings in which light and heavy parts are in close connection. This was very noticeable in a form of crank shaft, which was tried, having the counter weight cast with the shaft. The round portions of the shaft, cooling first, would draw upon the still molten interior of the heavier portion, and a large and dangerous blow-hole in the latter parts was the result. This hole was always entirely hidden, and was discovered in cutting into the counter-weight in making some alterations. Several plans

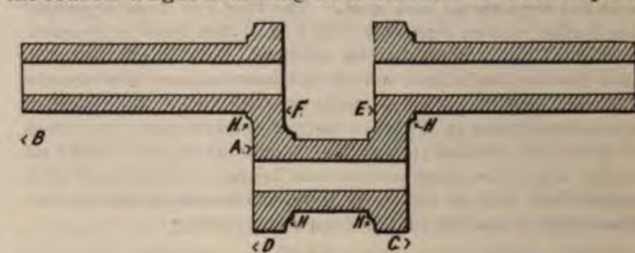



FIG. 34.

were tried to overcome this difficulty, and the best results are now secured by casting the shaft hollow, as shown in section in Fig. 34. A 1/2 inch core is sufficient for several sizes of shafts up to 1 1/4-inch diameter. This method seems to equalize the cooling of the casting. Core-prints for the body of the shaft should project 3/4 inch at each end, and should cross the gap at the middle of the pattern. For the pin, a projection of 1/2 or 3/4 inch at each end is sufficient. In machining such a shaft, the writer chucks one end, with the opposite end running upon a cone center, and turns a narrow circle near each end for a bearing in the center-rest of the lathe. Each end is then bored to as small size as will bring to a finished surface, and to a depth of about 1 or 1 1/4 inches, and plugs then turned upon centers to a drive fit for each end. The shaft is then finished like any solid shaft. In small motors, where saving of weight is very desirable, this method has added value.

The pattern for such a shaft will, of course, be a split pattern; and two pieces of stuff of a width 1/4 inch more than the diameter of the finished pattern, and one-half of this thickness should be glued together, with paper between. The length should be 3 inches more than that of the finished shaft without the plugs. This block is now to be turned to a diameter 1/4-inch greater than that of the finished shaft, thus allowing 1/8 inch of metal to be removed in the finishing. From one end, after cutting down with the slight draft necessary, the print should be measured, 3/4-inch long, and this part then turned to 1/2 inch diameter. From this shoulder measure a distance equal to AB in Fig. 34, plus 1/8 inch, and turn the print for the centre, also 1/2-inch diameter and extending a distance equal to CD, Fig. 34.

Follow the same general directions for the other end of the pattern including the core-print. Sandpaper and remove from the lathe. Drill the ends for dowel-pins and split the pattern. The parting-line of this pattern is shown at xy in Fig. 35. Four pieces of the same shape as shown in Fig. 36 should now be sawed for the cheeks of the crank. The distance AB is the same as the throw of the crank, or equal to ½ the stroke of the motor. The thickness of these cheeks should be such that the cross section of either complete cheek will slightly exceed that of the body of the shaft after deducting the area of the hollow centre. The width of the cheek, the other factor in determining this area, will, of course be governed by the thickness decided upon. The writer makes these cheeks 3/16-inch thick when finished, with good results, in very small motors. These cheeks may be left without draft upon the sides, provided extreme care is used in gluing them into place, to get no negative or back-draft. The semicircles are to be of the same diameter at the core-prints, and extreme care must be used to insure getting them exactly the same distance apart in all fan pieces. Before putting them together, the piece for the crank-

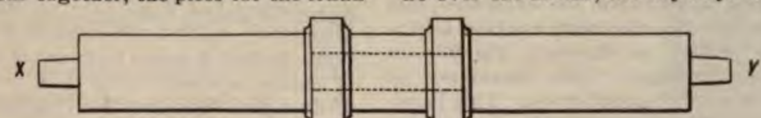


FIG. 35.

pin should be turned, with its core-prints, following the same general directions as for the shaft portion. The enlarged portion should have a length equal to the distance EF, Fig. 34, and the prints turned to extend through the cheeks and out at either side, say ½ inch. Now lay one-half of the shaft portion, preferably the half not to contain the dowel-pins, upon a plane surface, and glue two of the half cheeks into place upon the shaft, their inner side abutting squarely against the shoulders formed by the core-print in the centre. Before they set in this position, glue the crank-pin portion, or one-half of it, into its place, and if the work has been carefully done, the sides of the cheeks will be at exact right angles to the axis of the shaft and the axles of the shaft and pin will be parallel. Glue the dowel-pins into the other half of the shaft and place this part into position upon the first half, after the latter has had time to dry thoroughly. Glue the second set of cheeks into place, being guided by those already fastened, and glue the crank-pin into place. While the pattern is drying, pieces should be gotten out for the bearing collars H, Fig. 34. Saw a block from ¾-inch stuff to a diameter slightly in excess of the intended diameter of these collars. Place upon a screw-chuck and turn off the outside face slightly convex, to allow of necessary draft in the pattern. Bore out the inside for a short depth to the same diameter as the shaft portion upon the pattern. Turn the outside to the size and shape required. Sandpaper and cut off a thickness equal to that of the finished collar upon the metal shaft, plus 3/32 or ⅛ inch for finishing. It should be stated that the block from which these collars are turned must have the grain running at right angles to the lathe spindle. After turning four of these collars, split them, either by sawing to a line or down the centre with a sharp knife. The halves are now ready to glue into place, as clearly shown in Fig. 35. Wax all corners and shellac.

Should a core-box be necessary for the long core, the quickest way to get it out is to bore a ½-inch hole lengthwise through a block long enough for the box, and saw in two parts lengthwise, leaving a little more than half the hole in one piece. Make two pieces like this and plane the inner surfaces down exactly to a centre line described upon the oustide. Clamp the two halves over a ½-inch steel rod, to insure alignment, and bore for two or three dowel-pins, which should be a fairly tight fit. Saw the box to the proper length and leave the ends open. In making a slender core of this length it is always advisable to make the core-box in halves, as described, and dowel together. This insures a straight core without lap, which would be almost certain to be present if made in a single half. Sandpaper the inside of the box and shellac.

### PATTERN FOR THE CRANK-DISK.

In describing this pattern it is assumed that the two crank-disks revolving inside the crank-case are to constitute the fly-wheels for the motor. This method of construction possesses many valuable features, chief among which is the ability to make the crank-shaft of one piece of steel, yet keeping the rapidly moving fly-wheels inside the case, where they require less room and make the motor practically self-lubricating, throwing the oil contained in the case into every crevice. The usual form of construction, in which these disks constitute the fly-wheels, necessitates a built-up shaft, which, in the opinion of the writer, is an abomination. This opinion is based upon actual experience in repairing motors using this style of shaft.

The writer has employed several methods of fastening these disks to the shaft, including keyways cast in the crank cheeks and holes, with corresponding keyways cored in the disks to fit over the cheeks, the keyways to be filled with melted type metal, which, expanding during solidification, holds the disks firmly in place. Another method employed was to cast rings to be fitted over the crank cheek, which in this case were cast with counterweights integral with them and with the shaft. These rings were held in place by machine screws. The method now employed in several sizes of motors built by the writer, is to cast regular flywheels having a very light web, a hub bored to fit over the shaft, and as heavy a ring for the rim as possible or desirable. The counterweights are cast into these wheels upon the side opposite the pin. The hub need be only long enough to prevent the disk from springing when being fastened in place. This form of disk is fastened to the shaft by one machine screw, but all strain induced by centrifugal force or inertia when running is borne by a small key cast upon the end of each crank cheek and fitting a slot of similar size and shape cast in the disk, to be fitted to place by slightly filing. The machine screw simply prevents the disk from working loose and has no strain upon it whatever.

In making the pattern for this style of disk, segments should be built up and glued in a similar manner to that described for the piston-ring pattern. There should be either one or three or more layers of these segments in all such patterns. Two layers have a tendency to buckle or warp. All joints should be broken or alternated, as described for the piston-ring pattern.

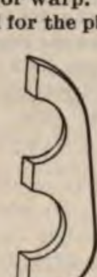


FIG. 36.

The web in disks for a small motor need be only ⅛-inch thick, and the weight of the rims and counterweights must be determined by experiment. Having determined the diameter of the disks, saw from ⅛-inch stuff a circle of ¼-inch larger diameter.

Saw one segment for a template, from which to draw the others. Six of these segments should be sawed from ½-inch stuff, to go upon one side of the disk for a "facing strip," to be

faced true in machining the casting. The balance of the segments for the rim may be sawed from ⅜ or ½-inch stuff, and are to be glued to the opposite side after fitting and nailing, as in the piston-ring pattern. The hub may consist of a facing piece upon one side, and a block, sawed larger than the finished pattern, upon the other. This pattern should be mounted upon a screw chuck if possible, but may be fastened to a wood face plate, as described for the he d, if such a chuck is not at hand. After turning the rim and one side, the pieces should be mounted with the other side out and that turned also. A green-sand core to form a hole in the hub ⅛-inch less in diameter than the finished shaft diameter is better than a dry-sand core requiring prints.

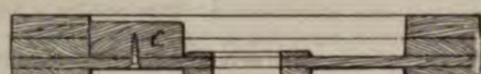



FIG. 37.

The hole for this core is best sawed upon the scroll saw, and should be given slight draft in a direction with relation to the draft in the balance of the pattern, as shown in Fig. 37. In this figure C shows the counterweight. This should not be glued into place, but held by a single small screw. This is advisable, because, in the course of experimenting, various weights will be found necessary to effect a practical balance of moving parts, and by removing this part of the pattern other sizes or shapes may be readily substituted in the new casting. A valuable point to remember, which is emphasized in this pattern, is that, in all patterns not split patterns, draft in the different parts should be so given that the side having the most difficult parts, the deepest places and sharpest corners, may be removed from the sand by rapping the pattern and drawing, and the side from which the sand must be lifted, as it is termed, should be the shallower side, which will offer less resistance to the sand in removing. Also, so far as possible, all parts upon one side of the pattern should be given draft inclining away from a perpendicular to the parting line. This is shown clearly in Fig. 37. This facilitates molding, and better prices may generally be secured upon castings from patterns in which this point has been remembered In the pattern for the crank case, description of which follows, this rule can not well be followed.

## MOTOR VEHICLES IN PUEBLO.

A press report from Pueblo, Cal., says that Stearns & Rogers, owners of the Iron City machine shops, have ordered a large passenger automobile—one that will carry about twenty-five people, for the purpose of carrying their men to and from their work. The "auto" will call each morning, between 6 and 7 o'clock, at given points in the city for the purpose of picking up and carrying to the works the employees of the shops. This action, it is understood, has been made necessary, because of the fact that there is no street car line any nearer than 24th street. In the evening the "auto" will take the workmen to the points at which they are gathered in the morning, or, if possible, to their homes.

The Riverview Cemetery Association, the owners of the Clark well, and several other parties who have interests in various parts of the city not reached by the street cars, are reported to be perfecting plans to organize an automobile company for Pueblo. They propose to organize a company with a capital of $25,000.

Morristown, N. J., has adopted an ordinance which provides that no conveyance "driven or propelled by power" shall be run in any of the streets of the town at a speed greater than eight miles an hour, and that all such vehicles shall be equipped with lights that can be seen 100 yards away at night, and with bells " which, when rung, may be heard 100 feet distant." The penalty for each and every violation of any of the sections of the measure is to be a fine of $10.

# LESSONS OF THE ∴ ROAD ∴

## A STEAM CARRIAGE DEVOTEE.

Natick, Mass., Aug. 12.

*Editor* HORSELESS AGE:

I have noticed from time to time letters in THE HORSELESS AGE relative to steam carriages. I have read these over with interest, and it is possible that my experience may also interest the readers of THE HORSELESS AGE.

I am a physician and have used a Locomobile for about eleven months. It was one of the first ones turned out, but has nevertheless done very excellent service. I have covered altogether over 16,000 miles, and the carriage is as good as new. In fact, it seems to improve with age. Slight repairs are, of course, necessary from time to time, but my total expense to date has been but $50. Even the tires, which are small two-inch pneumatics, are still in good condition and have yet a long life before them. The locomobile was used throughout the winter in all kinds of weather, and in my professional business I find no trouble in operating the carriage over snow and mud, and, by winding the pipes properly, have no difficulty with freezing.

Since I have received the locomobile I have found it a most practical vehicle, and have traveled throughout all the mountainous and sandy roads in Massachusetts, Connecticut and Rhode Island. My last trip was from Boston to New York, by way of Springfield, Hartford and Bridgeport, and returning by way of New London and Providence. Though the roads were sandy, it was accomplished without a mishap of any kind.

The difficulty in most cases with steam carriages is due to the carelessness of those who have been running them, and not to the fault of the carriage. I do not pretend to be an expert operator, nor do I think I have run the machine in any unusual manner, but I think that with regular inspection and careful operation, the steam carriage would give the best results for a physician's use, particularly in localities where roads are bad and hilly.

A. FRANCIS STORY, M.D.

## AN ENGLISH OPINION ON DESIGN.

August 9th, 1900.

*Editor* HORSELESS AGE:

I have read your article in your issue of the 18th, in reference to the form automobiles will and should take, and it certainly seems to me that you exactly hit the nail on the head.

Just at the same time I enclose you an illustration of the new 16 h. p. "Napier" car, in which I am interested, which I think you will see rather carries out many of your suggestions.

I have personally tried nearly every type of automobile, with the engines set in all kinds of positions, and I have come to the conclusion that ordinary engines set in the front of the car behind the front axle gives one the most convenient place for them. In front of the engine itself one has the radiators, then, just under the dash board, comes the flywheel, behind this comes one's arrangement of gearing, then comes the cross-shaft with the chain wheels on it, and then, away at the back, the back wheels.

The result of this is that, whilst you have a very expensive type of car to manufacture, you have an exceedingly effective one; everything is absolutely sealed against dirt or wet, and it makes no difference how filthy the roads are, you can run

hour after hour without being affected in the slightest. As nearly as possible the car balances absolutely between the centers of the two wheels, and the size of the wheels are 36 inches back, and 33 inches front.

We are building some 50-h. p. cars for the Gordon-Bennett Race for next year, and on those we anticipate making all four wheels of the same sizes. We have made the slightly smaller front wheels in the present cars in deference to public opinion, and not because we believe that it is either better or even as good as four equal-sized wheels.

To the iniated eye this long, low type of carriage is considered beautiful, and undoubtedly that which is correct must be considered sightly for the object it has in view.

S. F. EDGE.

[The machine referred to by Mr. Edge is the new 16-h. p. Napier, which we believe is the most powerful racer yet built in England. It is on the general Panhard lines, but with numerous modifications of detail. It has a quadruple cylinder, 4 x 6-inch motor, with the cylinders vertical and ranged in a fore-and-aft line. The machine was entered in the Paris-Toulouse-Paris race, but unfortunately the electric ignition got out of order, and tube ignition as an alternate had not been fitted.—ED.]

## MOTOR DELIVERIES IN DETROIT.

The Automobile Rapid Delivery Co., the first of its kind in Detroit, has been organized and incorporated with a capital of $25,000, with $3,500 paid in. The incorporators are John W. Goodson, president; Robert Parker, secretary; Hamilton O. Davis, general manager; and F. A. Updike, general superintendent. It is the purpose of the company to carry on only a parcel delivery system with a view of beginning a passenger service later on. Six automobiles have been purchased from W. E. Metzger. Later on an electric machine, with a capacity of nine passengers, for tally-ho rides, will be put into service. Permanent offices have not yet been selected.

## AN AUTOMOBILE FOR $1.88.

According to the *Motor-Car Journal*, a motorist named Martin Rucker not long ago sent his machine to an untimely end by too great an effort to be obliging. He was taking a run from Harrogate to Leeds, when he put the brakes hard on to accommodate the driver of two restive horses. The wheels skidded, and the vehicle rolled into the ditch. Then the gasoline caught fire, and in a very few minutes a handsome Daimler, which cost over $3,000, was reduced to twisted ironwork and charcoal. It is stated that immediately the flames showed themselves, Mr. Rucker, who could foresee the end, asked for a bid for the machine as it stood from a party of tourists from Leeds. A general dealer offered 7s. 6d. The offer was accepted, and Mr. Rucker returned with three half-crowns instead of the powerful machine in which he had set out. The general dealer may be said to have got ample value for his money, for the engine could not be greatly impaired by the fire, and will no doubt eventually be incorporated in some other car.

The de Dion-Bouton "Motorette" Co., of Brooklyn, N. Y., have secured C. G. Wridgway, the well-known English automobilist, as their traveling representative. Mr. Wridgway will presently start from Albany and make a trip through the Mohawk Valley, visiting Troy, Schenectady, Utica, Syracuse, Rochester, Buffalo, Dunkirk, Erie and Cleveland. From there he will go down through the carriage district of Ohio, and then either on to Chicago or back through Pennsylvania. The "Motorette" Co. desires that any manufacturers along the above route who would like to see the company's vehicles would communicate with them, and they will then arrange to have Mr. Wridgway call on them.

## THE CREST SINGLE CYLINDER MOTOR.

The Crest Mfg. Co., of Cambridgeport, Mass., whose "Duplex" motor is already well known, have recently brought out a new type of single cylinder motor, rated at 2¾ h. p., for tricycles and quadricycles. Like all the motors made by this company, it is of the air-cooled type, and contains, its makers tell us, several special features controlled by them.

The heads, cylinders, crank-cases, pistons and rings are stated to be cast from steel for the greatest possible strength and lightness. The cylinders are bored, ground, and afterwards lapped. The pistons and rings are ground, and the hardened steel crank pins and shafts are brought to size in the same manner. The connecting rods are drop-forged from tool steel, and the bearings are of nickel bronze. The flywheels, which are inside the crank-case, and constitute nearly half the weight of the motor, are the only cast iron parts.


The disposition of the ribs will be noticed. The Crest Co. claim that by this arrangement they are able to make the diameter and stroke from four to eight mm. larger than those of the largest air-cooled motors used abroad, and yet have the motor run cool under all conditions of service. By splitting the crank-case horizontally instead of vertically, the shaft, flywheels, rod and piston can be at once removed for inspection, without taking down any of the piping. The sparking device has selfcleaning contacts and adjustable lead, and is so arranged that the motor always starts with the sparker set for slow speed. No relief cock is used, the exhaust valve being lifted instead, and one handle controls both this appliance (when starting) and the subsequent lead of the ignition.

The elbow by which the mixture is led to the inlet valve is made so as to swivel to suit the pipe connections. It has a spring-closed relief cap or valve, which opens to the air in case of back explosions. This cap can be removed by the fingers, allowing the user to start a sticking valve without removing it from the motor.

As a special feature, the Crest Co. will furnish, at the request of any purchaser of this motor who wishes to build a motor tricycle, a complete set of full-size working drawings, with all dimensions, made from one of the latest types of French motor tricycles. The Crest Co. do not build automobiles themselves, confining their attention to the motors, but they make this offer to interest the small bicycle concerns in mechanical propulsion.

The Chicago *Inter-Ocean* says that a letter from the Comte de Dion states that the international meet at Chicago is receiving much consideration by members of that club, and that many are arranging their affairs to be present on this occasion.

# ...OUR... FOREIGN EXCHANGES

## THE AUTOMOBILE CONGRESS IN PARIS.

(Continued.)

As regarded the engines, they could not have one type for all kinds of vehicles. He (M. Bollée) said that the best work could be done with an engine running up to 600 revolutions a minute, and with a linear piston speed of three metres a second. There should be two cylinders, a perfect equilibrium of the moving parts, all the parts accessible and easily taken to pieces, a rigid underframe, automatic lubrication, cranks working in oil baths, and a simple arrangement of valves allowing a variable expansion and instantaneous reversing. An engine of this kind developing 25 horse-power would weigh 260 kilogs. (572 pounds). It would be preferable to employ the compound system, with the possibility of introducing live steam into the low-pressure cylinder for any special effort. Two compound couples, arranged tandem fashion, would not complicate the mechanism to any extent, and would certainly be an advantage in powerful cars. It was difficult to get at the average weight of an engine per horse power, as the information furnished by the makers themselves varied considerably, but he thought that by the employment of wrought steel they could get a motor from fifteen to twenty horse-power, all complete, weighing from twelve to fifteen kilogs. per horse-power. The lubrication of the piston and valves, by the introduction of oil into the steam pipes, gave good results, and the Consolin system of lubrication was recommended. The employment of atmospheric condensers was certainly good for flash boilers, but it was not so convenient for other systems, where the oily matter carried by the water soon clogged up the motor. The arrangements for rendering the exhaust invisible were based upon the drying of the steam by the superheaters, and good results were also obtained by allowing the steam to escape through little orifices coiled round the base of the chimney. The steam being thus divided, very finely came into thorough contact with the hot gases, and was dried to such an extent as to become invisible.

In his interesting paper on "Explosion Motors," M. G. Forestier dealt with the principles of the gasoline motor from a general point of view, and contented himself with summarizing the arguments for and against the various systems, without expressing a definite opinion upon any of them. He seemed to be by no means convinced of the superiority of electrical over incandescent tube ignition, though it had the advantage of allowing the power of the motor to be varied within certain limits.

M. Armengaud wanted to know why more attention had not been given in the paper to carbonic acid motors, and M. Forestier replied that if he had neglected the matter it was because nothing had been done in compressed and liquid gas motors. This reply did not satisfy M. Armengaud, who remarked that carbonic acid motors had given good results, and he believed that if inventors would try to perfect a motor in which the gas and air were introduced in small quantities they would do away with vibration. In 1870 he had some experience with a motor of this kind invented by Mr. Simon, of Manchester, which worked very satisfactorily, and he was surprised that nothing had been done with it. He thought that more attention should be given to this matter and also to the rotary engine. As a patent agent, M. Armengaud has his own views of the rotary motor, and M. Forestier, being a practical engineer, holds other opinions. He said that only a few days previously a man had brought him a rotary motor, and he had told the inventor to apply it to dynamos, for no satisfactory reduction gear had yet been devised to allow of its being applied to autocars.

This reference to carbonic acid gas reminded M. Chauveau of a new steam engine working in connection with liquid gas, which had recently been invented, and had gone through some very successful trials. He did not give any details of the system, but as he spoke of the necessity of increasing the admission of oil when extra power was needed for ascending gradients, it is to be presumed that the boiler is of the flash type. So far as could be gathered, the oil was always admitted in the same quantity, just sufficient to raise enough steam to allow of the car running over ordinary undulating roads, but when a gradient had to be taken the carbonic acid gas was delivered from a reservoir at a pressure of from forty to fifty kilogs. When the car stopped there was no pressure in the boiler, and in starting it was only necessary to operate a valve admitting the carbonic acid gas. The first two or three piston strokes were given with the gas, water was then injected, and steam was produced instantaneously. It was unfortunately impossible to get a clear idea of the system from M. Chauveau's description, though he seemed to have the greatest faith in its value. He could not give M. Forestier any information about the weight of the propelling mechanism, as it had merely been tried with a view of seeing whether it would work properly, and no account had been taken of the consumption and other factors. M. Chauveau then dealt with the respective advantages of electrical and incandescent tube ignition. He did not think that electricity was so efficient as the tube, and he sought to prove this by means of diagrams, which he said showed that the electric spark did not result in such complete combustion as the tube. For instance, the electric spark could only ignite, say, three or four molecules, and these communicated ignition to the rest of the mass, so that it could only be done progressively, whereas the tube, being surrounded by a gas, instantly ignited a considerable number of molecules.

The arguments of M. Chauveau were taken up by Comte de Chasseloup Laubat, who believed that there was a great disadvantage in employing carbonic acid gas, because it was not always possible to get supplies of gas away from the big centers. He alluded to a system in which the inventor employed liquid ammonia, in which the novelty was the utilization of the caloric properties for warming the reservoir containing the liquid ammonia. After the expansion in the cylinder the ammonia was dissolved in water, and this developed a number of calorics which were used to raise the temperature of the reservoir. A little engine of this type had been at work, but he did not know whether it had become a practical success. One member remarked that it was the Fournier engine, and another said that M. Tallier had built a similar motor ten years ago, while several systems were enumerated which showed that the liquid ammonia motor had received a fair amount of attention from inventors. Comte de Chasseloup Laubat did not see why the rotary motor of the Laval type could not be used on road carriages, though not, perhaps, in the present state. The difficulty lay in the high temperature and great speed. High speed meant great specific power, and this was that they were looking for in motor vehicles. Of course, in speaking of the high speed of the steam turbine, Comte de Chasseloup Laubat raised a difficulty, which at present seems almost insuperable, but he nevertheless said that it was worth while carrying out experiments. With respect to electrical and tube ignition, he would not say that in theory electricity was more efficient, but against this must be set off the fact that it was more easily regulated. With electrical ignition they were sure that the firing in the four cylinders took place absolutely at the same moment, but with the tube this was much more difficult, and, in fact, in a four-cylinder motor it could neve be properly regulated. At the same time he thought it quite possible that they could have variable ignition with incandescent tubes, which could be so placed as to be easily adjustable. The variation would not be much, but still it would be appre-

ciable. Another thing that they could not overlook was that electrical ignition took place in the mass of gas, whereas, in the case of the tube it was, of course, not so. Comte de Chasseloup Laubat then spoke of the various systems of balancing motors, and asked whether a balanced engine did not vibrate as much as the others, for in whatever way they placed the motors there was always bound to be a reaction against the movement. He thought that the four-cylinder motor gave the maximum of comfort, and with this system they arrived at good results without resorting to other experiments.—*The Autocar.*

(To be continued.)

## DEVELOPMENT IN CEYLON.

Considerable interest is being taken in Ceylon in the scheme of the newly formed "Ceylon Rapid Transit Company." This is a syndicate of local residents interested in the development of mechanical locomotion on ordinary roads, and the suggestion is that the government should abolish the unsatisfactory horse drawn mail coaches and send postal matters by automobile. An endeavor will be made to get the government to allow a trial between Negombo and Colombo. This route, it is believed, will fully answer the purposes of the experimental stage. The cars would be put on the road and would daily convey the mails to Negombo, returning the same night, and thus effectually justify the title of the Rapid Transit Company. It has been estimated that the cost of running these cars would range between 35 and 40 cents a mile. If the scheme is brought to fruition, the undertaking will open up the prospect of the employment of capital on a large scale, and it is to be hoped that no difficulties will be thrown in the way of the promotors, in arriving at a correct opinion of the possibilities of the venture after a full and thorough test. Cars are already on their way out which will be utilized in the interesting experiments shortly. These are being obtained from the Lancashire Steam Motor Company, whose headquarters are at Leyland. Other contracts have been placed, according to a Ceylon journal, with Coulthard and Company, of Preston, Lancashire; Simpson & Bodman, of Manchester, Bailey's Limited, London, and the Thornycroft Steam Wagon Co., Limited.

The cars it is proposed to adopt are built to carry eight first-class and ten second passengers, as well as mails and luggage at the back. The "cab" for the driver and the machinery is in front, entirely separate and distinct from the rest of the conveyance, whilst special means have been adopted to prevent heat or smell being obnoxious to those traveling. It is intended to run these mail coaches at a speed of about eight miles an hour, and the plans and drawings of the cars exhibited at Colombo have aroused considerable interest. The roads are good and present no great difficulties, and it is clear that, given facilities, a very much larger number of people would travel by coach than do at present. The company, of course, accept all risk on their account, and only ask that the expense they are being put to in providing these cars and the greater comfort and convenience for the traveling public which they provide, as well as the greater speed, should be acknowledged by a substantial subsidy from the government. Sir West Ridgeway is distinctly a progressive governor, and confidence is felt that his support to the scheme will be readily secured.—*The Motor-Car Journal.*

## FINEST ROADS IN THE WORLD.

The coral roads of Bermuda are said to be the finest in the world for the purposes of cycling. These roads differ from all others, inasmuch that they are as smooth as a billiard table, and are never dirty, however much the rain may drop.

In mentioning the "Concours de Moteurs" in our last issue, reprinted from *La Locomotion Automobile*, we omitted to state that it is published by Vve. Ch. Dunod, of 49, Quai des Grand Augustins, Paris.

## THE COOLING OF EXPLOSION MOTORS.*

As is well known, the explosion, in a motor cylinder, of a mixture of gasoline vapor and air, gives rise to a very high temperature which reaches even 1,500 degrees Cent., and communicates a considerable quantity of heat to the cylinder walls. The mineral lubricating oils ordinarily employed begin to decompose at from 350 to 400 degrees, and it is, therefore, apparent that unless a great part of the heat communicated to the walls is carried off, lubrication is impossible, and the piston will presently "seize" and stop the motor. Again, if the valves, especially the exhaust valves, reach too high a temperature, they oxidize and quickly warp and lose their tightness.

It is, therefore, indispensable to cool the cylinder walls of these motors, or at all events, such portion of them as is exposed to the heat of the explosion.

A part of the heat, it is true, is carried off by radiation and by contact of the air with the outer surface of the cylinder, but this is insufficient, as the outer surface of the cylinder does not present a sufficiently extended surface. By suitably disposed ribs or fins, one may improve the radiation, but this is adequate only in motors of small power, in which the exterior surface is relatively great in comparison with the volume contained. When the motor reaches about 3 h. p. in size, the ribs no longer suffice, and it is then necessary to have recourse to water. In this paper we shall concern ourselves only with the best arrangements to be employed in the latter instance, and we shall describe the systems in actual use for water cooling.

Two systems are commonly employed:

(1) Cooling by circulation of the water through the jacket;

(2) Cooling by evaporation of the water in the jacket.

We shall take up these systems in order.

### COOLING BY CIRCULATION.

This system, much the most widely used, consists in causing a stream of water from a tank carried on the vehicle to circulate through the jacket, either by simple differences in density or by the use of a pump. An apparatus called a radiator or refrigerator, interposed in the path of circulation, assures the cooling of the water and prevents it from being converted into steam.

We will take up in their order the following topics:

The manner of circulation, whether by "thermo-siphon" or by pump.

The circulating pump, its best mode of attachment and of driving.

The diameters required for the pipes by which the water enters and leaves the pump;

The radiator or cooling coils;

The best location for the latter;

The developed length required for them;

The best disposition of the cooling coils relatively to the motor and tank;

The precautions against freezing;

A résumé of the conditions, by fulfilling which the greatest efficiency of the ribbed coils is to be secured.

#### *Manner of Circulation.*

(1) By "thermo-siphon."

In this case the circulation is due to the difference in density between the hot and the cold [or less hot-ED.] water. The cold water, arriving from a tank above the motor and entering the lower part of the jacket, is heated and slightly reduced in density or expanded, and this causes it to flow upwards to the radiator and the tank by the return pipe.

This method of obtaining the circulation is the simplest, and it calls for no special mechanism. It is, nevertheless, the least used. For this there are several reasons:

(a) By reason of the small difference in the density of the hot and cold water, the circulation is very slow, a circumstance

* Extracts from the report of M. M. Grouvelle and Arquembourg, at the International Congress of Automobilism of 1900.

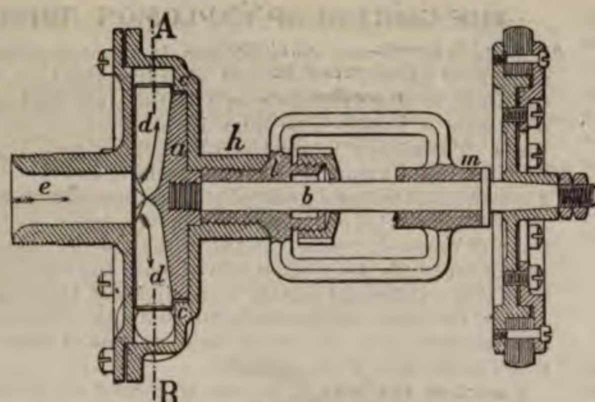


Fig. 1. Section through C D.

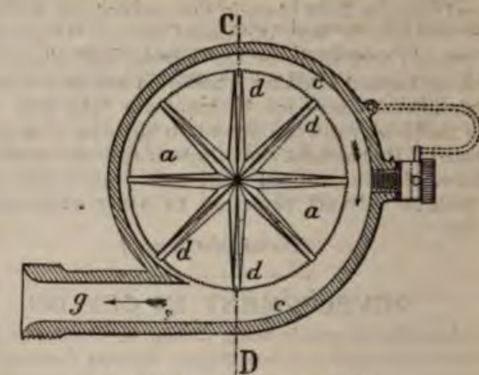


Fig 2. Section through A B.

THE "G A" CENTRIFUGAL PUMP.

unfavorable to the cooling, since that depends on the rapidity of the circulation;

(b) It is necessary to use tubes of relatively large diameter, to avoid carefully any contraction of the sectional area, and to use bends of large radius, so that these shall not impede the flow;

(c) It is neccessary to have the tank above the cylinder, and this is not always possible, especially if the motor is vertical.

Nevertheless, by reason of its simplicity, the circulation by thermo-siphon may with advantage be employed in all those cases where the arrangement of the vehicle lends itself to its use.

(2) Circulation by pump.

This method, though not as simple as the preceding, is that most used. The pump permits of giving a high velocity to the water, which greatly facilitates the cooling; the tubes may be made of relatively small size; and the water tank may be placed even below the motor.

*Attaching and Driving the Circulating Pump.*

The pump used should be simple, strong, easily managed, and able to deliver the water at a high pressure, and in the greatest possible volume relatively to its size

The centrifugal pump is the one which best fulfills these conditions.

The pump which we make* is composed of a disk a (Fig. 1), mounted on a horizontal shaft, which is rotated at a high speed. In this disk, and surrounded by a case whose circumference forms an expanding passage c, are cut out six radial channels d. The water, arriving by the central tubulure e, traverses the channels and escapes from the passage c by the tangential tubulure g.

The shaft of the disk passes through a support h, forming part of the body of the pump, and inside of which is screwed a phosphor-bronze bearing-sleeve l, a double-yoked extension of which ends in a second bearing m. The end of the shaft is made tapering, and the driving member (a rubber or leather-faced friction pulley, or a pinion or a grooved pulley) is made fast on this.

The first bearing h is sufficiently lubricated by the water which gets into it. The second, m, is supplied with thick grease from a cup. The phosphor-bronze bearing surfaces are very long, and their wear is insignificant.

We make these pumps in two sizes. The first has a turbine 50 mm. in diameter, and is used for motors up to 6 h. p. It is intended to run from 2,500 to 3,000 turns per minute, and at the latter speed it will deliver 39 litres per minute at a maximum pressure of six metres of water. The second has a turbine 80 mm. in diameter, and is used with motors from 6 to 20 h. p.

* The firm of Grouvelle and Arquembourg is well known in France as manufacturers of cooling coils and connected accessories.—ED.

It runs from 2,000 to 2,500 turns per minute, and at the latter speed it will deliver 55 litres per minute, at a maximum pressure of 9.5 metres of water. The above rates of delivery and pressures, however, are considerably greater, under like conditions, than can be obtained from the centrifugal pumps of other varieties.

It is well not to exceed the maximum speed above indicated, as it causes abnormal wear in the bearings. On the other hand, the minimum must be adhered to, as both the pressure and the delivery diminish rapidly with the speed in all pumps of this class.

When a rubber-faced friction pulley is used, care must be taken to avoid forcing it against the flywheel of the motor, as then the rubber, being laminated, tends to stretch and detach itself from its channel, in spite of all precautions to the contrary. The pressure of the shaft on the bearings, too, becomes very great, and produces rapid wear. The pressure should be such that the friction wheel can be easily turned by hand.

The leather friction wheel wears longer and is not torn by the flywheel, but it is less elastic. If from wear, or for any other reason, the flywheel is a little out of round, the rubber pulley will yield because of its elasticity; but the leather wheel will not yield, and it is necessary to use a spring to press the pump pulley against the flywheel. This arrangement is desirable in any case, since the pressure can thus be regulated and limited to a proper amount.

The pump is supported by a split collar, which surrounds the cylindrical part h and is hinged to the frame of the vehicle.

The level on which the pump is placed is not a matter of indifference. It should never be so located as to draw the water up to itself, for when the water is very hot the least reduction of pressure would result in the formation of steam and the consequent failure of the suction. It is, therefore, necessary to place the pump below the level of the tank, so that the water will flow to it from the latter by gravity.

*Diameter of the Orifices of Entrance and Discharge.*

The diameter of the entering orifice of the pump will not necessarily be the same as that of discharge. It will be understood that a quantity of water must flow to the pump at least equal to that which is discharged, else the circulation will be intermittent†; and the volume of flow in the supply pipe will depend on the elevation of the tank, above the pump with the elevation given, the diameter of the pipe must be large enough to permit of the required flow. If we grant that the minimum head will be 250 mm., then, to get 55 litres per min., which is the capacity of our large pump, we calculate that the supply pipe and orifice must have a diameter of 18 mm. For the discharge pipe we have adopted a diameter of 15 mm. For the small pump, with a capacity of 39 litres per min., the supply

† That is, the supply pipe and orifice must be large enough so that the water will flow to the pump by gravity as fast as the pump delivers it under pressure; otherwise the pump will have to assist gravity by sucking the water down.—ED.

pipe is made 15 mm. in diameter (the same head being assumed) and the discharge pipe 12 mm.

*Water Coolers or Radiators.*

As we have said, the water, which absorbs heat in its circulation through the jacket, is cooled very little in the tank to which it then returns. The tank is commonly concealed, not exposed to the air, and moreover, presents a very small radiating surface relatively to its capacity. The water, therefore, returns to the motor very hot, and quickly reaches a temperature of 100 degrees Cent. in the jacket. It then passes into steam, which escapes into the air, or is confined in the tank. The water supply, therefore, diminishes steadily, and after a certain time it must be renewed.

In the early motor vehicles the motors were of low power, and a tank of moderate capacity sufficed to avoid the need of too frequent refilling; but in proportion as the power of the motors has been increased it has been necessary to enlarge the tanks or refill them oftener.

To avoid this inconvenience, it is indispensable to cool the water after it leaves the jacket, so that its temperature shall never reach 100 degrees. The same supply of water will then last a long time, and as its cooling capacity is increased, the action of the motor is improved.

In accomplishing this cooling it was natural to think of utilizing the violent current of air produced by the increasing rapid motion of these vehicles. The problem consisted in finding an apparatus which, in small compass, should present a considerable cooling surface, while being of light weight and offering as little resistance as possible to the air. The use of ribbed tubes was plainly indicated; but the iron or cast metal tubes, used elsewhere for heating or cooling, could not be thought of, their dimensions and their weight being both far too great.

We have, therefore, applied ourselves to the construction of very small and very light ribbed tubes, using tubes of copper and ribs of very thin sheet metal. The latter are fixed on the tubes in such a manner that, while the ribs are very firm, yet the tubes can be bent around a very short radius, which permits of getting a great length of tube into a small space.

Our three sizes of tubes are as follows: (1) inside diameter 12 mm. [0.48 in.], with rectangular ribs 45 x 35 mm. [1.80 x 1.40 inches]; (2) inside diameter 15 mm. [0.60 inches], with square ribs 40 x 40 mm. [1.60 x 1.60 inches]; (3) inside diameter 18 mm. [0.72 inches], with square ribes 50 x 50 mm. [2 x 2 inches.].

The following table gives the cooling surfaces and weight of these ribbed tubes:

| Inside Diameter. | Cooling Surface per metre of length. | Weight per Metre. | |
|---|---|---|---|
| | | Aluminum Ribs. | Iron Ribs. |
| 12 mm. | 0.255 sq. m. =2.74 sq. ft. | | 1.36 kilo. =3 lbs. |
| 15 mm. | 0.2465 sq. m. =2.65 sq. ft. | 0.815 kilo. =1.8 lbs. | 1.1 kilo. =2.4 lbs. |
| 18 mm. | 0.263 sq. m. =2.83 sq. ft. | 1.2 kilo. =2.6 lbs. | 1.8 kilo. =4 lbs. |

The cooling capacity of the tubes of 12 and 15 mm. diameter is sensibly the same, and that of the large tubes about 50 per cent. higher.

Although the ribs are made of either iron or aluminum, the latter metal has no advantage except in point of lightness, the radiation being practically independent of the nature of the metal used. The iron ribs are very thin, but by stamping a small circular channel in them, they are made sufficiently rigid. For general use the 15 and 18 mm. tubes are preferred to the smallest size.

Ribs substantially flat, like the above, have the advantage over irregular or zig-zag ribs that they do not retard the air passing by them to the same extent. The latter, moreover, retain the dirt that gets on them when the cooling coils are under the vehicle, and are difficult to clean.

(To be continued.)

## THE VOITURETTE "LA PLUS SIMPLE."

This voiturette, which is built by René Legros at Fécamp and is exhibited at the Champs de Mars, is distinguished by the extreme simplicity of its mechanism, in which everything is reduced to its simplest expression. It is of exceptional strength, and its organs have been so worked out and disposed as to require the minimum of attention.

From the power of the motor, which is very efficiently cooled by reason of its location at the front of the vehicle, and is said to develop 4 h. p., the vehicle will readily climb grades of 12 per cent., on its low speed, carrying 250 kilogs. of passengers or baggage. On the level it will go 30 or 35 kilogs. (20 miles) an hour.

THE VOITURETTE "LA PLUS SIMPLE."

There are two brakes: the first, a very powerful one, is worked by a pedal and acts on the differential. The second, operated by a lever, acts on the hubs of the rear wheels, which are the drivers.

The ignition is electric, with variable lead, and the circuit is broken by the pressure of the foot on a pedal. The voiturette weighs, in running order, from 30 to 40 kilogs (500 to 525 pounds).

The speed-changing gears run in a bath of oil, and do not turn when the vehicle is in the high speed. M. Legros exhibits an electric vehicle also at the fair.

## IAN MACLAREN'S WORLDLY WISDOM.

The celebrated novelist, Ian Maclaren (Rev. Dr. Watson), has ventured on another voyage of discovery, which will, in all probability "be productive of much good," as the preachers say. The other morning, at the early hour of five, the Rev. Dr. Watson, accompanied by Professor Hele-Shaw, of Liverpool University College, set out from the house of the former, Croxteth Road, Liverpool, on a motor-car belonging to the professor. They were accompanied by an engineer, and their ultimate destination is Scotland. They were in high spirits, and were in hopes of breakfasting at Preston, whence they make for Windermere, and in easy stages go to Stirling. This is the novelist's first experience of motor-car riding, but under the skilful guidance of Professor Hele-Shaw, there is no doubt the trip will be a delightful and enjoyable one.

And this leads us to another point. In order to thoroughly enjoy motoring, the novice must be accompanied by a practical person. Otherwise the delights of the journey may fade as the chances of progress diminish. There are people who have an idea that the propulsion of a motor-car is like working a musical-box or winding a keyless watch. At present the management of a motor-car has not been reduced to kodak-like simplicity, and Ian Maclaren shows much worldly wisdom in the choice of his associates on this—his first—motor-car trip.—*The Motor-Car Journal.*

## THE ROCHET MOTOR TRICYCLE.

Some particulars of the Rochet motor tricycle, which has made an excellent record for itself in France, are given in a recent issue of La France Automobile.

As will be seen from Fig. 1, the motor is mounted just back of the rear axle. The vaporizer is of the constant level float feed type, and is illustrated in section in Fig. 2. The gasoline, entering below, passes through a metal gauze at R, which screens it of solid impurities. The float F carries on its top the weighted arms of two levers, and when these arms are raised, the short arms, acting on the needle stem A, close the aperture through which the gasoline enters the chamber B.

From B the gasoline passes by the tube D to the spraying nozzle E, whose mouth O is slightly above the level of the gasoline in B.

Warm air is drawn from around the cylinder of the motor, and enters at I. The gasoline, being drawn up by the suction of the air, sprays on the inverted cone H and is mingled with the air, the mixture passing out at J on its way to the cylinder. Further air is subsequently admitted by an adjustable inlet not shown, and a valve allows of throttling the mixture to vary the speed. A small quantity of exhaust gas is admitted to the chamber V, where it assists in vaporizing the gasoline. The plug G is for cleaning out the accumulated solid impurities below the gauze.

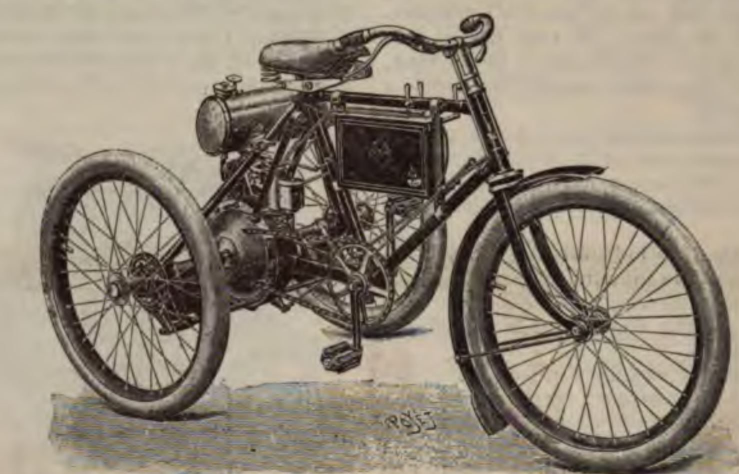


Fig. 1. Rochet Motor Tricycle.

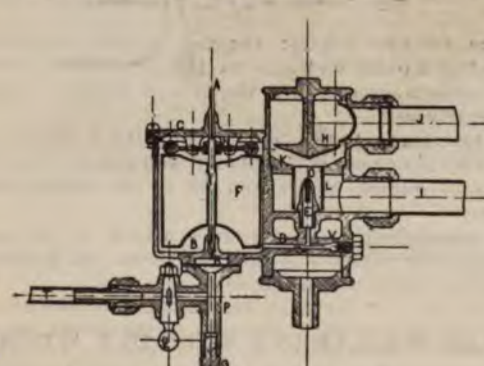


Fig. 2. Rochet Vaporizer.

A feature of the tricycle is a provison for automatically breaking the battery circuit when the brake is applied.

The transmission gears are clearly shown in Fig. 3; $g$ $g^1$ are the studs carrying the differential pinions, and are forged solid with the central sleeve, in which the ends of the axle-halves are aligned. The differential drum carries the gear A, driven by a pinion on the motor shaft, the brake drum B, and the starting sprocket C with its releasing gear. By means of partitions on each side, the brake B is shut off from the gear A and from the sprocket C, and this enables the two latter to be covered with grease without affecting the brake's action. By the ears F the sleeve $f$ $f^1$ of the gear case is solidly bolted to the crank case of the motor, thus insuring alignment.

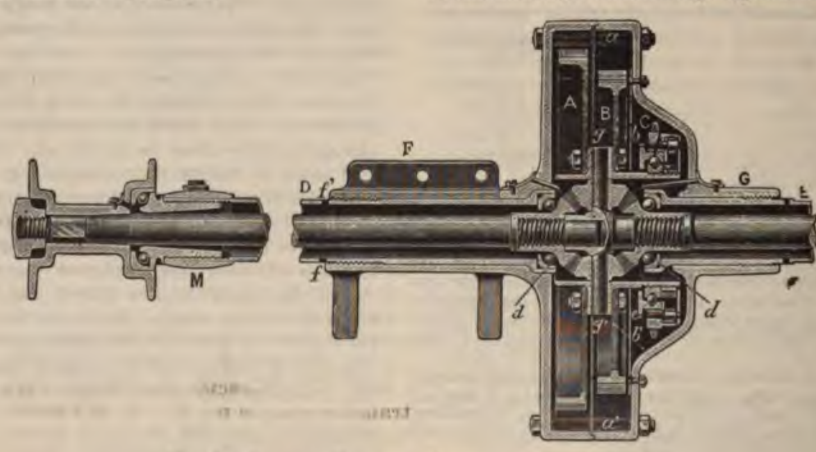
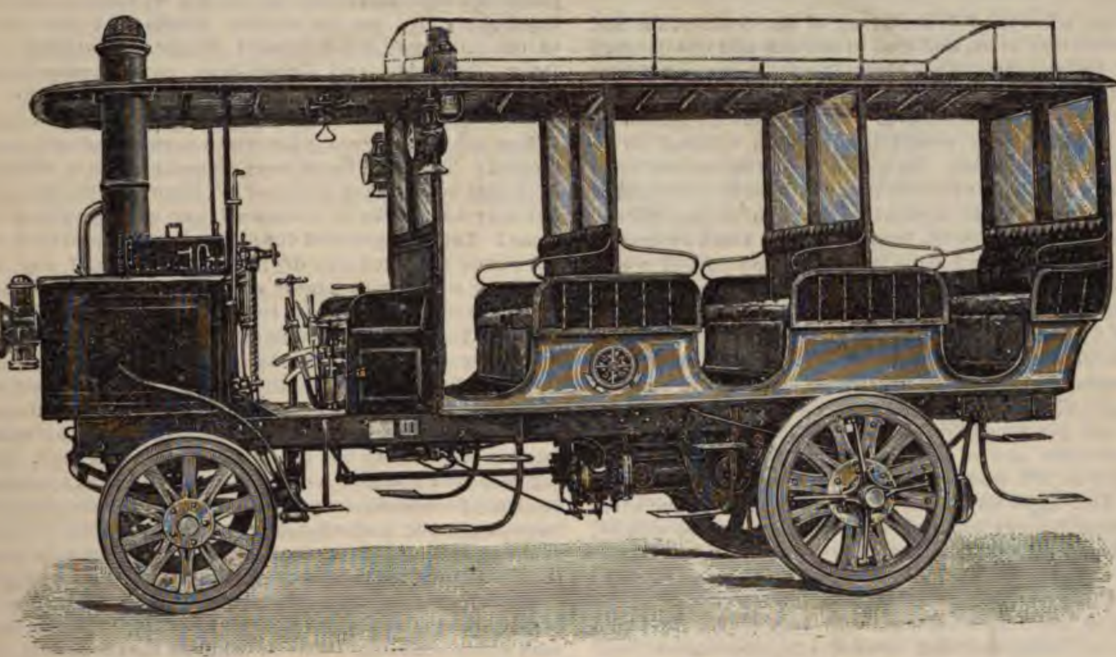



Fig. 3. Rochet Tricycle Transmission Gearing.

## THE DE DION STEAM CHAR-À-BANC.

Although de Dion, Bouton & Cie. are best-known abroad by their light vehicles, they are still busily engaged on the construction of heavy steam cars, and this week we publish an illustration of a huge 20-seated char-à-banc of a type which is now being used for public service in various parts of France. The boiler, which is carried on the front platform, is of the firm's own tubular type. Coke fuel is employed, the consumption being stated to be about four kilogrammes per kilomètre traversed. The engine is of the horizontal compound reversing type and is of 30 h. p. capacity. The water tanks have a capacity sufficient for a run of 30 kilomètres, while coke for a 70-kilomètre trip can be carried. The car is fitted with a mechanical change speed gear, and can, it is stated, ascend gradients of 10 per cent.



De Dion Steam Char-a-Banc for 20 Passengers.

## MOTOR-VEHICLE COMPETITIONS IN FRANCE.*

The competitions here reported are two: the first, in 1898, called the competition of heavy weights, and the second, in 1899, of motor-cars plying as street cabs. Steam, gas and electric motor-cars are here dealt with as commercial vehicles, for which the chief consideration is their profitable working. For pleasure conveyances aiming at speed, regardless of expense, the problem of mechanical traction has already been solved, and an average speed of 30 miles an hour has been attained as easily as on railways. By taking advantage of the progress realized in this direction, conveyances can now be propelled by mechanical power with greater economy than they can be drawn by horses; and the author's object is to show how this result has been brought about.

The steam carriages competing in 1898 included two omnibuses, a pleasure van, a brake and a dray; their boilers were fired either with coke, oil or common spirit; the first was burnt in a water-tube boiler, the second in a Serpollet boiler, and the third in an ordinary vertical boiler with flue tubes. Their average speeds are given for a run of about 200 miles; also their speeds on a level, up-hill on steep gradients, and down-hill under control of the brakes. The gasoline carriages in 1898 comprised two omnibuses, one of which had a compound motor, and a brake, and a dray. Their speeds are given under the same conditions as those of the steam carriages. The electric vehicles in 1898 were two suburban delivery vans, carrying throughout the trial their full loads. Allowing for the necessary stoppages of all kinds in regular daily working, tabulated details at considerable length are compiled of the consumption per ton-mile in the passenger vehicles, and of the cost per mile per passenger with luggage; from which it was concluded in 1898 that for passenger traffic these means of mechanical conveyance can be employed commercially with advantage to the public and with profit to the capital invested. For goods' traffic, on the contrary, for which similar tabulated details are given, it was concluded that under present conditions it is difficult for mechanical traction on roads to compete with horses in regard to ordinary loads, not exceeding what can be drawn by a team of five or six horses with one driver. A self-propelled conveyance would have the advantage for a load exceeding nine or ten tons, or for a speed exceeding 2½ miles an hour. Hence it was recommended in 1898 that instead of aiming at high speed with light loads, the object should be to carry heavier loads at a speed of more nearly four miles an hour, whereby the cost of conveyance would be materially reduced. While nine miles an hour would be desirable as an average commercial speed for an omnibus or similar passenger conveyance, four miles an hour would be acceptable for drays worked by steam or gasoline, carrying three or four tons, and traveling not more than about 30 miles a day.

In the 1899 competition of motor-cars, plying as street cabs, there were included also town-delivery vans carrying a minimum load of 10cwt. For the cabs the day's cost was estimated so as to include the power consumed between the stables and the stand and while crawling empty, and also the loss while on the stand, as well as the power expended when conveying fares. Trials were made of the controlling efficiency of the brakes down-hill, and of the consumption of power on a level and up-hill; and runs of 37 miles were made over a specified route. The characteristic feature of the cabs was the mode of transmitting the power. In one driven by gasoline, the speed was varied by mechanical means, with a chain from the motor

*F om the British Inst. C E.: Foreign Abstracts.

pinion to the driving wheel in the rear. In two others, electrically driven and using a chain, the speed was not varied mechanically; but the reduction from the motor to the rear driving wheel was constant, and the speed was varied by modifying the current. Others electrically driven, without a chain, had a pinion on the motor, gearing direct into a toothed wheel keyed on to the axle of the driving wheel, which was in front; the motor itself was centered upon the pivot, about which the driving wheel swivelled in steering; and this bold expedient has been justified by the results of more than a year's regular working in Paris. With pneumatic tires one electric cab had two motors, which were hung loose on the axle, having their ends suspended from a flexible plate, and their armatures were geared to the driving wheels through intermediate pinions; while in an electric delivery van with iron tires the same maker fixed the motor on the suspended frame of the vehicle, and used a chain for conveying the power to the driving wheels.

The weights, when loaded, are given of six electric cabs and two electric delivery vans, and also of one cab and one delivery van driven by gasoline; also their speeds under conditions similar to those in the previous year. The gasoline motor throughout came well to the front. There seems no reason to fear lest 12 miles an hour would be too high a speed to be authorized for such vehicles. Up a steep hill the electric cabs surpassed the gasoline cab; while the electric vans were behind the gasoline van. The accumulators in each of the electric cabs were furnished daily with from 8 to 12.4 kilowatt-hours. Per cab per mile the consumption was from 158 to 242 watt-hours, assuming 75 per cent. as the efficiency of the nearly new Fulmen accumulators used in all the cabs. The consumption per ton-mile was ascertained from special trials carefully made on a good level, macadamized road at different speeds, and the range of consumption corresponding with the range of speed is stated for each vehicle separately; the lowest was from 64 to 94 watt-hours per ton-mile for speeds of from 6.3 to 14.3 miles an hour with one of the delivery vans, and the highest was from 105 to 161 watts-hours per ton-mile for speeds of from 6.2 to 14.9 miles an hour with one of the cabs. The total cost of working per day for the six electric cabs, whose weight, including load, ranged from 22.9 to 34.6cwt., was from 15s. 6d. to 16s. 1d., out of which the cost of power was from 8.6d. to 1s. 4d. For the gasoline cab, weighing loaded 25.5cwt., the day's cost was 18s. 7d., including 5s. 6d. for power. The two electric delivery vans, weighing loaded 128 and 65cwt., cost respectively 15s. 10d. and 14s. 6d. per day, of which 4s. and 2s. 8d. was for power. The gasoline van, weighing loaded 42.6cwt., cost 16s. 8d. per day, including 6s. 5d. for power. An increase of nearly 50 per cent. in the total weight adds, therefore, but little to the daily cost; whence it appears that, instead of striving to reduce largely the weight of the accumulators, it will perhaps be more economical to adopt even heavier accumulators, which, working at a lower rate of discharge, will cost less for maintenance. But it remains to be seen whether the diminished cost of maintaining heavier accumulators will be counter-balanced by the increased cost of maintaining the elastic tires of a heavier vehicle.

Still better results are anticipated from the international competition in 1900, which it is hoped will include all vehicles suitable for city traffic—private carriages, street cabs, collecting and delivery vans, and railway omnibuses.

## TIRES AND TRACTION.

A source of much of the opposition to traction engines, and one that was not touched upon in my last notes, is the use of cross pieces or other projections upon the tires. These are necessary uncts to their working even during dry weather, since the adhesion with smooth tires would be insufficient for the propulsion of the 10-ton engine pulling three trucks, having a gross weight of 30 tons. It appears that traction engine builders prefer to adhere to this large unit of three trucks and the ribbed tires, which spell trouble with road authorities, rather than attempt the perfection of one smaller, more mobile, and self-contained, upon the lines of an ordinary lorry. In traction-engine practice a weight of seven tons upon the driving wheels has to provide the adhesion for moving a total weight of 40 tons, whilst in motor-wagon practice five tons on the drivers has to provide the adhesion for moving only 12 tons. It is, therefore, sought to obtain more than a double efficiency per ton on the driving wheels in the case of the traction-engine, and this difference between the two systems, though apparently a simple one, is of far-reaching importance. It means that smooth tires never can suit the traction-engine. . . .

Whether smooth tires will give satisfactory results on the motor-wagon is a question that calls for investigation, for an affirmative finding must be another strong point in favor of the modern form of road locomotion. It has certainly been proved to demonstration that in dry weather a motor-wagon requires no ribs on the driving wheels. At the 1899 trials of the Liverpool Self-Propelled Traffic Association, Everton-Brow, Browside, and Rupert-lane, paved respectively with sets, macadam, and cobble stones were successfully climbed and descended with loads of freight up to six-and-a-half tons. (These gradients are only known to carters and cart owners by repute!) The same loads were manœuvred into berths at the dock-side in less than a couple of minutes. So far so good; but may not murky or continued wet weather prove troublesome? Let it be granted that during nine months in the year the roads are hard and dry, what provision, if any, must be made for working on greasy surfaces, soft macadam, or snow? Fortunately, we can turn to the experience of Fuller & Co., Chiswick; Fox Bros., Wellington; Messrs. Guiness, Dublin, and other users, who have kept records over lengthy periods. It is satisfactory to note that, during the last two winters, no difficulties have risen except from snow. This, after several experiments, was overcome by the temporary attachment of adjustable shoes to the tires of the driving wheels. In working on paved streets covered with a film of sticky mud, a slight tendency to side-slip from the crown towards the curb has been counteracted by a small deflection of the steering-lever, but this skidding is now practically cured by an increase in the length of wheel-base. In the country, when loose and wet macadam has been travelled over after heavy rains, there has been no trouble through the road material "lifting" on the tires. We may safely conclude, from the evidence that is slowly accumulating, that smooth tires are efficient during the whole year, both in town and country, except on muddy hills of excessive steepness and in snow. These difficulties can be and have been met by special attachments which cost little and are easily fitted or removed, whilst, for continued working under adverse conditions, the leading manufacturers are making interchangeable wheels, which will be kept in the running shed of any haulage company for use when required. It is, of course, clear that in a city so well cleansed as Liverpool, whose streets are a bright example to the large majority of provincial towns, such expedients will rarely be resorted to.—*The Liverpool Journal of Commerce.*

## SEEING BERLIN.

A motor-vehicle drive was recently organized by the proprietors of one of the leading hotels in Berlin for the benefit of its many foreign visitors. Arrangements were made with the Berlin Motor-Wagen Gesellschaft to supply a number of vehicles with drivers. No less than thirteen cars were altogether required, these consisting of both petrol and electrically driven vehicles, ranging in size from a victoria up to a large motor-omnibus. Upwards of seventy persons joined the party, who visited the leading places of interest in the German capital and the Mausoleum in Charlottenburg. The drive occupied three hours and a half, and according to all accounts was much enjoyed.—*The Motor-Car Journal.*

## FRIGHTENING HORSES.

Ernest Estcourt, a London motorist, whose starting device was described in the HORSELESS AGE of January 10 last, writes as follows to a Norwich paper regarding frightened horses:

"My experience, after driving cars 30,000 miles without injuring man, woman, child, or dog, is that the best thing to do in passing vehicles going in the same direction is to get by at a good pace. The horses take less notice, and when once passed, the quicker the car is in leaving the horses the better for all. In meeting a horse it is better to come near at a good speed, as by so doing the engine can be thrown out of gear, and the car run past on its own momentum, thus saving the noise of the engine and gear. Experienced motor-car drivers have found this is best, and in a few years the drivers of horses will think so too, and not trouble so much about the speed as the care of the driver in other respects, such as preventing noise, giving plenty of room, not attempting to pass until there is room, not blowing the horn near horses, etc. My experience also teaches me that in nine cases out of ten the drivers of horses are much more frightened than the horses are. In proof of this I would say that my London stables are situated in a mews where there are about 200 horses, and although I have kept my cars in the center of this mews and opposite a stable that usually contains 120 horses, I have never once been asked to stop for a restive horse. The men expect me to drive in and out just the same as though I was driving a horse."

## RUNNING DOWN CHILDREN.

It is not very generally understood that young children cannot in law be held guilty of contributory negligence. The legal consequence is that, in an ordinary accident case, a cyclist will be found liable in damage, even although in point of fact, a child has been equally to blame. I am dealing, of course, with the case where there is fault on both sides, and where, had the person who was injured been an adult, he would not have recovered damages. A case which was recently tried at Manchester County Court will illustrate this. Damages were claimed on behalf of a child who had been knocked down in the street by a cyclist. In giving his decision, Judge Parry said that, had the plaintiff been an adult, judgment would have been given for the cyclist, but in the case of a child, the law as to contributory negligence was different. The cyclist admitted he was riding without brake or bell, and that although he carried a whistle, he was unable to use it promptly, as it was attached to his coat. He could not, therefore, give an effective danger signal. After the accident the cyclist acted most promptly in caring for the child, and the judge regretted that its friends had not accepted the terms that were offered. Judgment was given for 30s., with costs. The moral is obvious, and the law is clearly this—that the whole onus of responsibility, where a child is concerned, is thrown upon the adult cyclist. The greatest care must always be exercised where there are children about.—*The Scottish Cyclist.*

## THE STRAIN OF ROAD RACING.

Speaking of the Paris-Toulouse-Paris race, a correspondent of the London *Daily Express* says:—"Several of the competitors avowed their unwillingness to compete again in so exhausting an event; and it is possible, if not probable, that long-distance racing may die a natural death rather than suffer actual suppression at the hands of the authorities.

"The winner of the Gordon-Bennett race, M. Charron, was a notable absentee, though his car was driven by M. Voigt. A friend of mine saw M. Charron a few hours after the Gordon-Bennett race; he was then in bed, in a state of great prostration, and expressed his disinclination to go through such a nerve- estroying struggle again. The conditions themselves of the more recent race were much less trying, but the heat made all the difference.

"At the same time, both the race just over and the Gordon-Bennett race emphasize the superhuman nature of de Knyff's achievement in the Marseilles-Nice event, when he averaged 43½ miles an hour on a continuous run of over 800 kilometres."

## LIQUID AIR.

In a recent number of the *Sibley Journal of Engineering*, Dr. Robert H. Thurston discusses the possible sources of energy for automobiles, and expresses his views on the subject of liquid air as follows:

"It stores comparatively little energy, is enormously costly, especially as a competitor with energy-storage fluids of little or no cost, requires very large quantities per horse power delivered, and no known way exists for its storage for any considerable or satisfactory period, without immense waste. According to Linde—perhaps its most successful, experienced and reliable producer—it requires 100 horse power at the compressor to produce as many pounds per hour, and it can develop but a fraction, probably a small fraction, of that amount of power in regasifying. It loses by simple vaporization, even in large vessels, 10 gallons and upward, about four per cent., under the most favorable conditions for its preservation, each hour. Its efficiency in the motor is found to be about four per cent.; that of the steam engine is from 7 to 20 and more, and that of the gas engine ranges to still higher figures. In the perfect heat engine the quantity of air required to do the same work within the same range of temperature of operation is about sixteen times as much as of steam; while steam costs nothing as a crude material and liquid air costs no one knows precisely what—probably not less than three or four times, perhaps ten or fifteen times, as much as the fuel used with steam engine or the gas engine.

"The wild claims of the promotor of the stock companies now in the market for speculative purposes are probably based on but little better reason than those of Keeley or of other mountebanks. Taking its cost in the engine at the advertised minimum, about $8 per ton, and that of steam in the engine at about $0.00025 per pound., about 50 cents a ton, and $4 for coal, the relation is 16 to 1 in favor of steam per pound, and many times this per horse power developed. A first-class steamship of 10,000 horse power would probably pay $100,000 for the air alone to operate the proposed system of machinery in a single voyage across the Atlantic. We are, however, still awaiting exact data, and the proposing investor in this field will meantime do well first to ascertain the exact character and records of the men with whom he must deal, their intellectual as well as moral reliability, and their standing as scientific men as well as mechanics and mechanical engineers; next to secure by personal observation and measurements, or through a trustworthy and reputable expert in that specialty, precise figures of power expended, product secured and costs of power and product, and, finally, its availability as shown, not through prophecy, but by actual experimental and life-size work, for the particular purpose in view. It is always perfectly practicable to ascertain just what the business side of the proposition may be expected to be worth through a careful and accurate investigation, by properly conducted experiments, by well-known and reliable methods familiar to every member of the engineering profession.

"The best evidence that the writer has thus far collected indicates that the cost even of refrigeration, in ordinary cold-air work and transportation, as of fruits by train, must be several times as much with liquid air as with ice. The former, costing about sixty times as much as the latter, pound for pound, is capable of far less refrigerating effect per pound. In no ordinary work can liquid air compete with ice or the refrigerating machine."

## MINOR MENTION

H. H. Buffum, a machinist of Brockton, Mass., is at work on a motor carriage.

The United Power Vehicle Co., of New York, will locate its factory in Rutland, Vt.

It costs $20 to speed an automobile faster than eight miles an hour in Princeton., N. J.

The Automobile Rapid Delivery Co., Detroit, Mich., has been incorporated with a capital of $25,000.

The Standard Motor Vehicle Co., of Camden, N. J., has been incorporated with a capital of $250,000.

Mrs. Frank E. Norton is the first woman automobilist of Syracuse, N. Y. She drives a steam surrey.

J. H. Kinsley, of Burlington, Vt., has taken the agency for that state of the Locomobile Co. of America.

James McNaughton has opened a store in Pittsfield, Mass., for the sale of the "Mobile" steam carriage.

The Ayers Gasoline Engine & Automobile Co. is a new comany which will shortly locate in Saginaw, Mich.

J. O. Lyle, of Butterfield, Minn., claims to have invented a practicable self-propelling attachment for heavy field artillery.

The Detroit Automobile Delivery Co., with Dr. C. H. Pfuntner as manager, and offices at 127 Wayne street, has also been organized.

The General Automobile Co., capital $125,000, has been incorporated in New Jersey. Its principal office is at 60 Grand street, Jersey City.

The United States Lunch Wagon Co. has been succeeded by the T. H. Buckley Co., of Worcester, Mass., which proposes to build self-propelled lunch wagons.

H. F. Borbein & Co., of St. Louis, Mo., have sent us a neat pamphlet giving illustrated descriptions and prices on their line of running gears and parts.

The only motor carriage in Topeka, Kan., is owned by Terry Stafford, owner of a small machine shop in that city. Mr. Stafford built the entire machine himself.

The newly formed Pennsylvania Automobile Club held a run on Sunday, the 19th, starting from the Philadelphia Automobile station, 138 N. Broad street, and going to Willow Grove via Chestnut Hill.

Ernest V. Sloan, of Bridgeport, Conn., chief engineer of the American Graphophone Co.'s plant, has been for some time at work on a gasoline carriage of his own invention. It is now reported to be nearly completed.

The Munson Safety Automobile Co., capital $125,000, has been incorporated under New Jersey laws. Its office will be at 60 Grand street, Jersey City, and it will manufacture motor vehicles under the Munson patents.

The Ashton Valve Co., Boston, Mass., have sent us a circular and price list of their small steam fittings for vehicles. These include pop safety valves, cylinder relief valves, water gauges, cocks, and pressure gauges.

It is reported that E. W. Tucker, who is connected with the E. P. Allis Co., of Milwaukee, intends forming a company to operate a public livery of motor vehicles in New Orleans. The vehicles will be of Mr. Tucker's invention.

Rochester, N. Y., is considering a speed ordinance similar to that proposed in Syracuse. The speed for all vehicles is limited to eight miles an hour, which is reduced to six within a radius of one-half mile from the city's center.

The Police Commission at Newport, R. I., has refused to grant permission for the automobile and locomobile races for the prizes which W. K. Vanderbilt, Jr., intended giving. The refusal was made in view of the protests of the cottagers.

The Enlind Mfg. Co., capital $1,000,000, has been incorporated under New Jersey laws. K. Arvid Enlind, the inventor of the non-slipping pneumatic tire, a test of which was reported in these columns a few weeks ago, is one of the incorporators.

A new organization, known as the Pennsylvania Automobile Club, has been formed. The following are its officers:—Dr. F. L. Sweany, president; Julian Haugwitz, vice-president; Henry J. Johnson, secretary; Charles E. Wright, treasurer; Dr. S. Leon Gans, captain of runs.

A company, with H. A. Logue at the head of it, has been organized to operate a public service of motor vehicles on the streets of Chambersburg, Pa. A few machines, carrying half a dozen passengers, will be bought to start with, and ten-cent fares are reported to be intended.

Though the records show that there is over half a billion of dollars capitalization for automobile construction companies, there is little fear of a financial panic among them. The ones who are actually manufacturing seem to have enough to keep them going, and the others have not the wherewithal to make a failure.—*The Wheel.*

The Chicago Automobile Club, which was organized August 10, intends to increase its membership from 34 to 350. It is the opinion of its members that speed contests on the road arouse public resentment and do much to injure the cause; and it has been determined to accept no person as a member who makes a habit of entering such contests with his machine.

The motor vehicle owners of Minneapolis treated the County Commissioners to a country run on August 10th. Thirteen vehicles made the start, going to Wayzata, on the shore of Minnetonka Lake. On their return, dinner was served at the Lafayette Club, after which came an informal discussion on the subject of good roads and the need of them in the country around Minneapolis.

One of the features of interest which will be a part of the program at The Inter-Ocean Automobile Exhibition and Meet at Washington park, Sept. 18 to 22, will be the gathering of representatives of various cities to consider the question of municipal license and control of horseless vehicles. The Inter-Ocean has been assured that a representative convention of city officials from all parts of the country will assemble. It is expected general laws for the regulation and control of the motor-vehicle will be recommended.

The Joseph Dixon Crucible Co., of Jersey City, N. J., claim especial merit for their powdered graphite when used in connection with the usual cylinder oil in steam and gas engines. It is well known that only the best mineral oil can be used in the exacting conditions of the latter work; but even this chars or burns up entirely, under the influence of the heat, while graphite is unaffected under the same conditions. Special graphite lubricants are prepared for gearing and for sprocket chains. When used on chains, no grease should be used with the graphite, as it gathers dirt. Instead, the graphite should be used with a nice quality of vaseline, or should be mixed with gasoline or turpentine, and applied to the chain. The gasoline or turpentine will evaporate, leaving a thin coating of graphite on the chain.

# MOTOR VEHICLE PATENTS ∴ ∴ OF THE WORLD ∴ ∴

## UNITED STATES PATENTS.

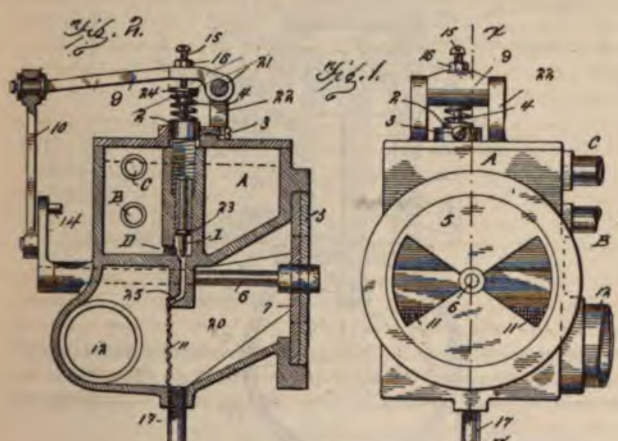
654,818—Sparking Igniter for Explosive Engines.—H. C. Thamsen, of Hamburg, Pa., assignor of two-thirds to A. Murdoch, of same place, and A. H. Leader, of Reading, Pa. July 31, 1900. Application filed April 17, 1900.

654,888—Steam Generator.—Joseph Giroux, of New York, N. Y., assignor of one-half to Frederic Tetreau, of same place. July 31, 1900. Application filed November 29, 1899.

654,894—Regulator for Gasoline Engines.—S. A. Hasbrouck, of New York, N. Y. July 31, 1900. Application filed August 5, 1899.

The object of this invention is to throttle or restrict the inlet openings for air and gasoline, to the vaporizer, by equal amounts.

The air enters by the disk valve 5 7, each disk of which has openings, as shown in Fig. 1 One disk is stationary, and the other mounted on the shaft, 6 and turning therewith, closes the apertures in 7 by greater or lesser amounts, according as it is turned.



654,894.

A is an overflow chamber, with inlet B and outlet C. By the passage D the gasoline flows down past the needle valve 1 and rickles over the wire gauze 11, where it is vaporized in the stream of air which goes through the gauze and passes out at 12 to the engine. The needle-valve is free to move longitudinally through the sleeve or regulating-screw 2, and is provided with a shoulder 23, which engages with the lower extremity of such regulating-screw. The screw 2 is in screw-threaded engagement with the casing of the chamber, as indicated in the drawings, and when adjusted to the desired position may be locked in place by the set-screw 3. An expansion-spring 4, between the upper end of the screw 2 and the head 24 of the needle-valve 1, tends to raise the valve and holds the shoulder 23 in engagement with the lower end of screw 2.

A link 10 connects the arm 9 with a pin on the operating-arm 14, and when the latter is turned from its normal vertical position, at which both valves are wide open, the link draws down on arm 9, and this partly closes the needle valve 1.

A modified arrangement dispenses with the screw 2, and uses a plain sliding stem, held up against arm 9 by a spring, and moving up and down with the arm.

654,996—Gasoline Motor.—Stephen Messerer, of Newark, N. J., assignor to the Messerer Automobile Co., of New Jersey. July 31, 1900. Application filed June 8, 1899.

The leading feature of this invention is the use of a cylinder and piston as an exhaust muffler, the piston moving rapidly out at the moment when the exhaust valve is opened, and the exhaust gases being thereby expanded into the cylinder without external noise.

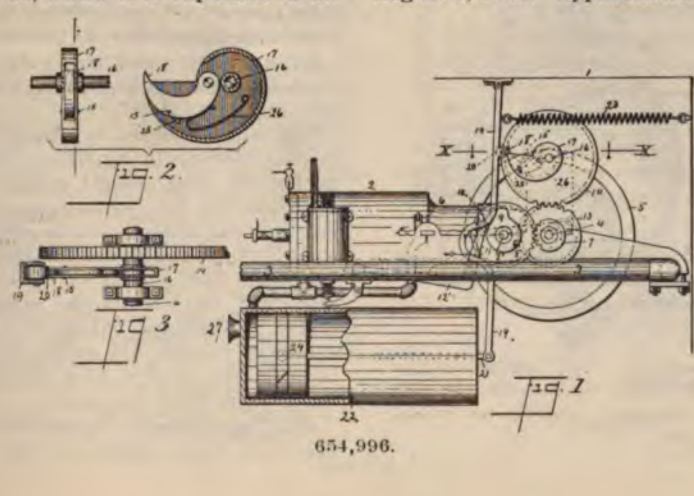
In the drawing, 2 is the working cylinder and 22 is the exhaust cylinder. The piston 24 is worked by the lever 19 and the cam 17, which, as seen, is intended to allow the piston to be drawn out as quickly as possible. An ingenious feature, by which a little time is saved, is the use of a loose cam-piece 18, pressed out by a spring, but which will retract itself immediately when the center of the roller has passed its point or toe.

As the lever 19 is forked for the roller (see Fig. 3), we presume it is cut away for the point of the cam to get through it, although this is not mentioned. Doubtless also a buffer is used to bring piston 24 to rest at the end of its course without wrecking the lever which operates it, and probably an air cushion on the other side of the piston would accomplish this as well as anything.

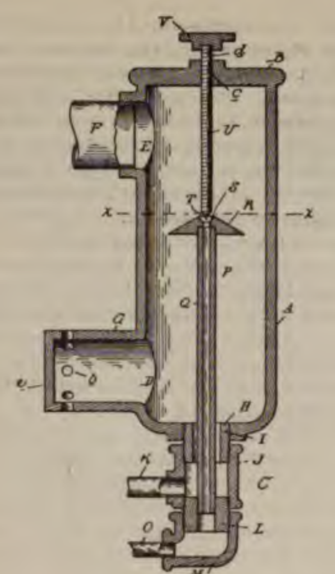
655,172—Carbureter.—W. S. Olds and D. M. Hough, of St. Louis, Mich. July 31, 1900. Application filed Dec. 26, 1899.

In this carbureter the air enters by the aperture b of the port D, and the mixture of air and vapor passes out at F. The gasoline enters at O and passes up the tube Q to the needle valve opening S, where it spreads over the cone R and drips off, being evaporated meanwhile by the up-going stream of air. Any unevaporated residuum returns to the tank by the pipe K. Nothing is said as to whether the gasoline flows out under pressure, but this seems to be intended.

655,183—Pneumatic Tire Fastening.—J. A. Berger, of Chicago, Ill., assignor of one-half to J. P. Larson, of same place. August 7, 1900. Application filed January 15, 1900.



654,996.



655,172.

655,186—Rear Compression Explosive Engine.—Henrik A. Bertheau, of Stockholm, Sweden, August 7, 1900. Application filed July 20, 1898.

655,269—Starting Device for Explosive Engines.—R. R. von Paller, of Nuremberg, Germany. August 7, 1900. Application filed June 5, 1900.

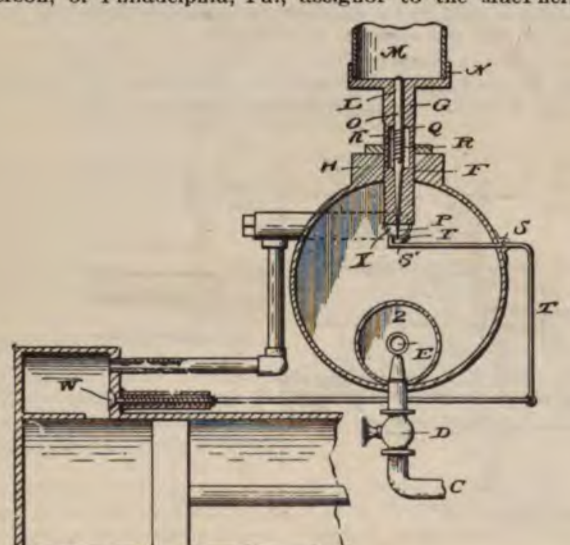
655,289—Igniter for Explosive Engines.—Louis Witry, of Waterloo, Iowa., assignor to the Waterloo Gasoline Engine Co., of same place. August 7, 1900. Application filed December 19, 1899.

655,320—Autotruck for Garbage, Ashes, Etc.—J. C. Anderson, of Highland Park, Ill. August 7, 1900. Application filed September 23, 1899.

655,321—Autotruck Vehicle.—J. C. Anderson, of Highland Park, Ill. August 7, 1900. Application filed September 23, 1899.

655,329—Motor Vehicle.—J. T. Dougine, of Chicago, Ill. August 7, 1900. Application filed July 27, 1899.

655,406—Electric Sparker for Gasoline Engines.—J. G. MacPherson, of Philadelphia, Pa., assignor to the MacPherson Automobile Co., of New Jersey. August 7, 1900. Application filed November 22, 1899.



655,407.

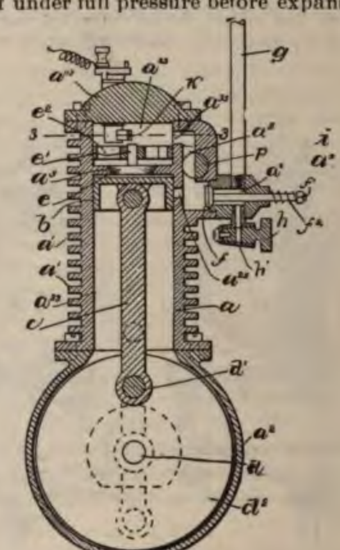
A quick-acting lift sparker with snap cam.

655,407—Vaporizer for Gasoline Engines.—J. G. Mac Pherson, of Philadelphia, Pa., assignor to the Mac Pherson Automobile Co., of New Jersey. August 7, 1900. Application filed November 22, 1899.

In this invention, 2 is a heating chamber supplied with exhaust gases by the tube C. Air enters at a point not shown, and passes by the pipe X to the engine cylinder. The gasoline arrives via the pipe M and needle valve P, which the spring R keeps normally closed. The suction valve W of the engine is connected by a link to the lever T, which opens the needle valve when W opens, and thus gasoline can enter the vaporizer only when the valve W is opened by the flow of air.

655,473—Gas Engine.—E. C. Wood, of Somerville, Mass., assignor of one-half to T. W. Gleeson, of Boston, Mass. August 7, 1900. Application filed August 9, 1899.

In this engine there is a partition, $a^3$, separating the cylinder space from the combustion chamber, with a check valve e opening upward from the former into the latter. A passage, $a^{25}$, admits the pressure to the top of the piston after the latter has moved down a little on its power stroke. The only apparent merit of the arrangement is that it allows the combustion to complete itself under full pressure before expansion begins. It



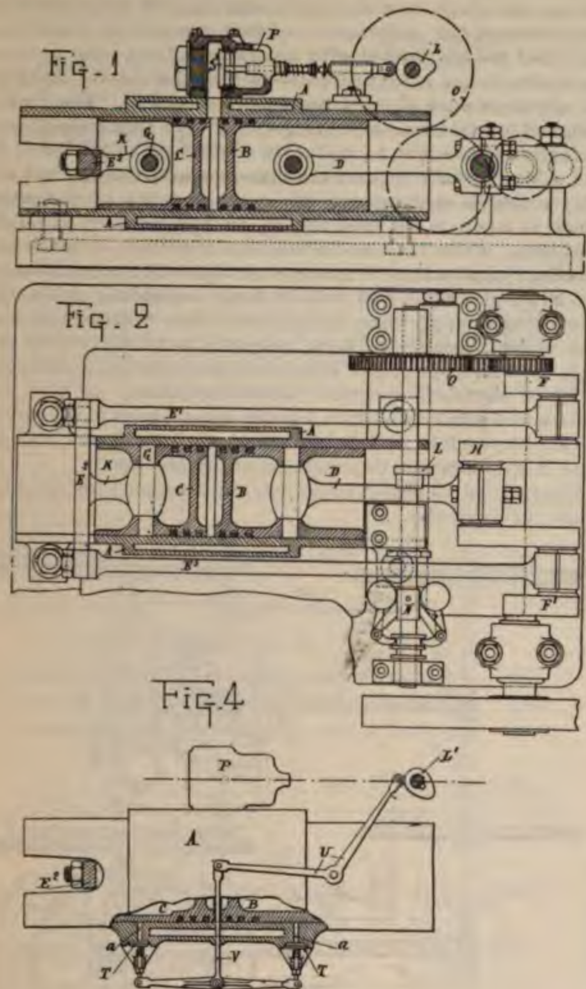
655,473.

is probable that all the advantages thus gained, and quite possibly one or two other besides, would be had if the valve e were omitted, the partition made solid, and the mixture entrapped after the port $a^{25}$ was covered were allowed to compress and expand, igniting when the piston reached the point $a^{25}$.

655,475—Multiple-Piston Petroleum or Gas Motor.—Ch. E. Calloch, of La Flèche, France. August 7, 1900. Application filed August 14, 1897.

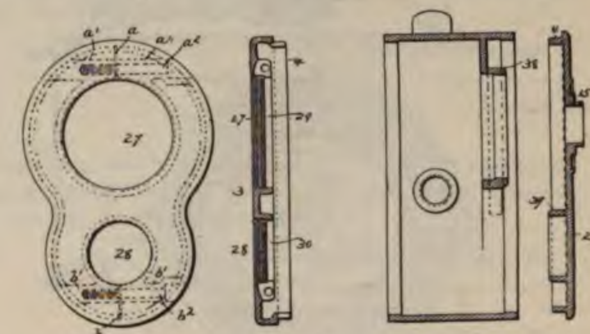
This motor is of the well-known balanced type, having two pistons moving in opposite directions in a cylinder open at both ends. The general arrangement is well shown in the drawings, the leading feature out of the ordinary being that no crosshead is used with the second piston C. The yoke $E^2$ is rigid with the rod K and the rods $E^1$ $E^3$, the result being that the piston itself acts as a crosshead. The inlet valves are suction-lifted, and are on the same horizontal plane with and beside the exhaust valves $S^1$. In order to obtain as full a charge as possible, the auxiliary inlet valves T $T^1$ (Fig. 4) are mechanically opened after the springs on the regular inlet valves have closed the latter.

655,558—Variable Speed Mechanism.—M. C. Johnson, of Hartford, Conn., assignor to the Helix Gear Co., of same place.




655,475.

Though the mechanism is intended primarily for bicycles, yet it is of interest as a well worked-out and compact transmission arrangement. Three speeds, with no reverse, are provided for At the normal or medium speed, the crank-shaft 5 is clutched to the sleeve 18, which carries the sprocket wheel 24, and the latter is driven at the speed of the crank-shaft. The other speeds are preferably one lower and one higher than the "normal." The sleeve 18 is carried in ball bearings, mounted in the case, and two spur gears, 46 and 47, are keyed to the sleeve. The shaft 5 runs in ball bearings in the crank hubs and carried by the sleeve, and this shaft has keyed to it a spur gear 44, meshing with a gear 43, which is keyed to a secondary shaft 41 below the other. Two gears, 45 and 48, run loosely on this shaft, and mesh with gears 46 47. A positive clutch ring 49 connects the one or the other of these gears with the shaft 5, and these pairs of gears give, respectively, the high

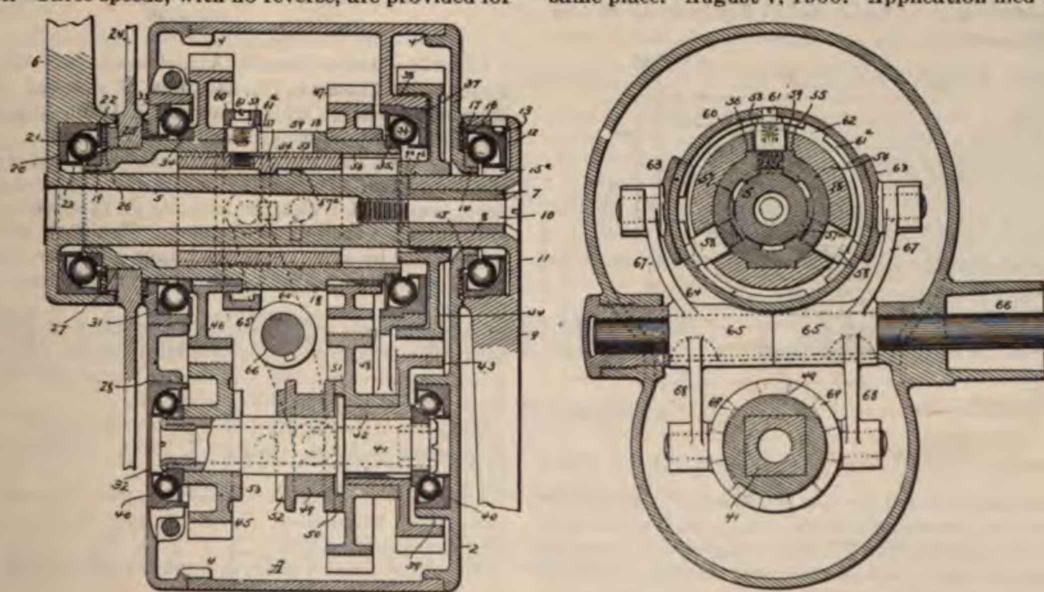


655,558.

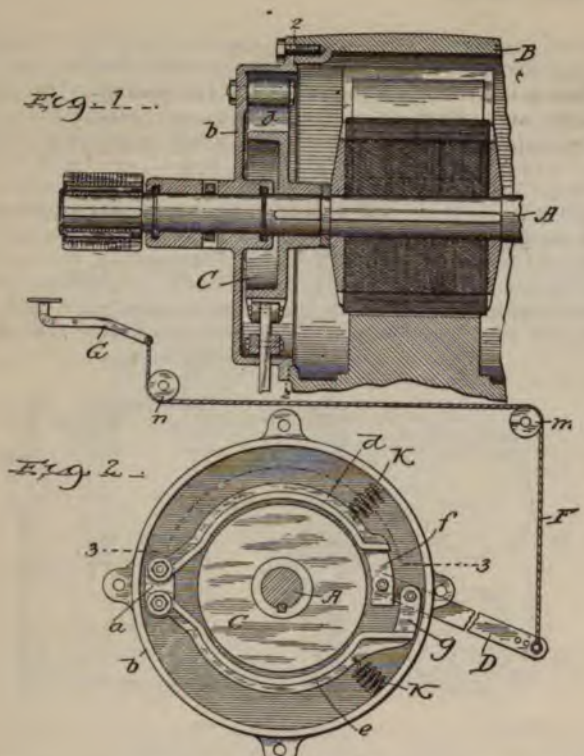
and low speeds. The ring 49 is shifted by the levers 68, and when it is in mid-position both gears are loose. The levers 68 have upper arms 67, which shift a ring 54 lengthwise inside the sleeve 18. This ring has studs 58, sliding in slots in the sleeve, and also internal teeth 57, which, when the ring 54 is in mid-position, engage with other teeth 57a on the shaft. In this position the sleeve and sprocket are driven directly by the shaft. When it is desired to pass from the low to the high speed, or vice versa, the teeth 57 will readily slip past the teeth 57a.

The detail figures show clearly the form of the case and the "face-plates" which close it in.

655,562—Brake for Electric Motors.—Chas. A. Lindstrom, of Chicago, Ill., assignor to the Hewitt-Lindstrom Motor Co., of same place. August 7, 1900. Application filed May 5, 1899.



655,558.

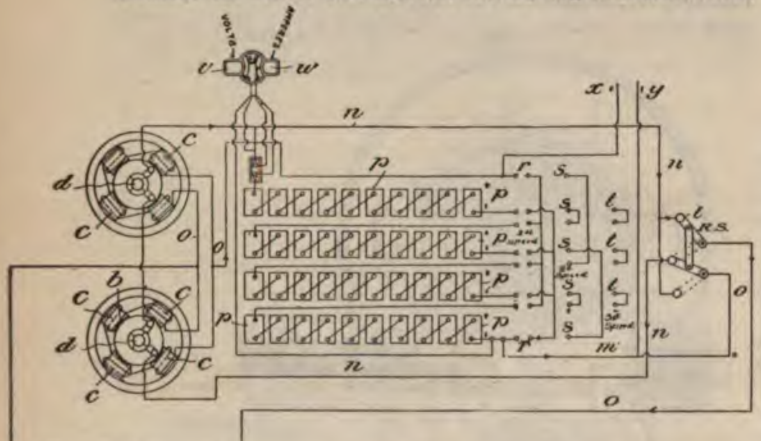


655,562.

By this invention the brake is enclosed in the shell of the motor itself, and is, therefore, nearly dust-proof. The drawings are self-explanatory.

655,563—Electric Carriage.—Chas. A. Lindstrom, of Chicago, Ill., assignor to the Hewitt-Lindstrom Motor Co., of same place. August 7, 1900. Application filed March 3, 1900.

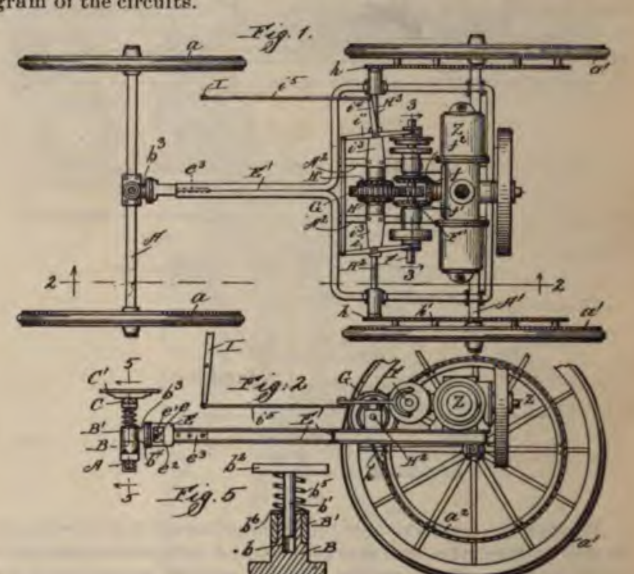
The leading features of this invention, which concerns only the motor and not the running gear or body, are as follows: The non-use of pole-shoes on the magnet poles, by which the eddy currents, formed at the joints where such shoes are bolted to the cores, are avoided, and the efficiency is claimed to be increased; the use of two motors, one driving each rear wheel;



655,563.

the permanent connection of the field windings of both motors in multiple with each other, and of the armatures in series with each other, which is claimed to improve the efficiency; and the use of the thinnest possible air-gap between the pole pieces and the teeth of the armature core. Regarding this last feature, the inventor says: "The established rule heretofore prevailing among electrical manufacturers and experts concerning air-gaps between the armatures and field-magnets of motors has been that the air-gaps should not be less than one-quarter of the width of the armature-slot—that is, the groove or slot in the armature-core wherein the wires are placed. The reasons assigned for this rule are, first, with a very small air-gap the excitation is too low to maintain a stiff field at full load; second, eddy currents become troublesome, and third, great difficulty arises in maintaining the exact amount of excitation, which is much more essential in multipolar than in bipolar machines. These reasons are sound and correct, so far as their practical application to motors of high voltage is concerned, but are not sound, and are, in fact, misleading when it is attempted to apply them to motors of low voltage (80 volts and under), because in such motors I have discovered that such wide air-gaps create resistance, generate heat, and cause a loss of electrical energy. Therefore, contrary to this well-known and established rule, I make the air-gaps in my motors as thin as possible, and by reason of such unusually thin air-gaps largely increase the efficiency of my motors."

A battery of 40 cells is preferred, and the figure shows a diagram of the circuits.



655,670.

655,670—Motor Frame Attachment for Vehicles.—L. E. Brookes, of Chicago., Ill., assignor of one-half to Sidney M. Weir, of Cleveland, Ohio. August 7, 1900. Application filed April 11, 1898. Renewed December 15, 1899.

The leading features of this invention will be apparent from the drawings. The motor, by a bevel pinion f, drives two bevel gears $f^1$ $f^2$, which are loose on an intermediate shaft, and are connected thereto by clutches. This shaft drives the differential shaft by spur gears, and spur gears or sprocket chains connect the two halves of the differential shaft with the rear wheels.

The front axle swivels by a fifth wheel, and will swivel vertically also, to allow for inequalities in the road. No change gears are provided, and the motor frame and reversing gears are a dead weight on the rear wheels.

655,660—Steering Mechanism for Vehicles—G. L. Reenstierna, of Winchester, Mass. August 7, 1900. Application filed October 9, 1899.

655,661—Fuel Receptacle for Gasoline Engines.—G. L. Reenstierna, of Winchester, Mass. August 7, 1900. Application filed October 28, 1899.

A tank having its bottom weaker than the rest of it, so that the bottom will blow out first.

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### PRICE OF COMMERCIAL WAGONS.

Those who believe in the motor vehicle as a great revolutionizer of the world's transportation methods on roads will be pleased at the evidence afforded by this number that substantial progress is now being made in the development of commercial motor vehicles in the United States. Large concerns, whose experience with motive power and whose capital and general standing are a guarantee of success, are preparing to manufacture heavy steam vehicles on a large scale. The first model of one of them is described in this issue, and others will follow shortly.

The first question which confronts both manufacturer and user of work wagons at this juncture is what will the price be and what will be the saving over horses?

Many tables of the comparative cost of motive and animal power in commercial fields have been compiled since the new locomotion came into public notice. Most of them are based on insufficient data, some are too sanguine, while a few, emanating from sources very close to the horse, have prejudice stamped on every figure. But while accurate data may be wanting, it is now generally admitted by all except those who are wilfully blind, that a reliable motor wagon will effect a considerable saving over horses in all fields where it is at present available. And this brings us to the consideration of a point which has an all-important bearing on price, namely, reliability and durability. If a motor wagon is to displace a horse oufit, it must compare favorably in these two essentials with the system it is intended to supplant. Wagons may be built, which will make a very satisfactory showing at exhibitions or at temporary trials, but are wholly inadequate to the demands of regular service. Ignorant of the requirements of the case, the user is misled by appearances and a false standard of values is created, which temporarily retards the industry and is detrimental to the interests of both the competent manufacturer and the consumer.

The truth of this has been forcibly exemplified in England, where several manufacturers of commercial vehicles adopted the light and cheap wagon and for a time led the market, while the more conscientious builder was obliged to stand by and wait for his vindication. After a few months' service these cheap wagons were fit only for the scrap heap; the wear and breakdown were so complete that repair was out of the question. The disappointed purchasers were in most cases ready to listen to higher prices and heavier, better construction. Meantime, however, much harm had been done the industry. The wiser policy is to produce a durable and reliable machine, confident that when its merits are proved it will command a fair price.

In comparing English and American prices of heavy motor wagons, we are apt to lose sight of one very essential fact, and that is that our streets and roads are far worse than the English and our problem is, therefore, more difficult than theirs. The rougher the roads the stronger and more carefully must the machine be built to stand the strains. English prices, therefore, must not be taken as a standard by the American manufacturer without this qualification. An experienced American manufacturer, who is entering into the heavy motor wagon business, estimates that a four-ton dray at $3,500 will effect a saving over a horse outfit of the same capacity of about $2,500. If this is approximately correct, the margin in favor of the motor is so large that builders should have no hesitancy in setting a price that will enable them without

doubt to build strong and durable vehicles. Our roads are rough and full of pitch holes, it is true, but the worst rut the heavy motor vehicle builder can run into is the rut of cheapness. It will be fatal to success.

## REVISED PROGRAM OF THE INTER-OCEAN TOURNAMENT.

The program for the Inter-Ocean Exhibition and tournament to be held at Chicago, September 18 to 22, has been changed in many details. On TUESDAY, SEPTEMBER 18, the program of events will be as follows:

Grand parade for manufacturers—First prize, gold medal, for greatest number of practical designs; second prize, gold medal, for greatest number of autos in line; third prize, silver medal, for most practical and unique design.

One mile race, flying start, free for all—For steam automobile, first prize, gold medal; second prize, silver medal. For gasoline automobile, first prize, gold medal; second prize, silver medal. For electric automobile, first prize, gold medal; second prize, silver medal.

Obstacle race—Prize of a gold medal for best time in passing through obstacles.

Grand parade for private owners—Gold medal for most elegant turnout; gold medal for auto carrying greatest number of seated passengers.

Ten-mile race, free for all—First prize, gold medal, to winner; second prize, silver medal, to most dexterous operator; third prize, gold medal, to best appearing vehicle.

Fancy and trick driving contest (open to all types of vehicles)—Gold medal for most difficult tests and practical demonstration.

Fifty-mile race for motor tricycles—Cash prizes to first and second.

WEDNESDAY, SEPTEMBER 19—Manufacturers' practical utility test—Prizes, gold and silver medals.

Heavy draft contest for manufacturers and merchants—Prizes, gold and silver medals.

Auto-gun carriage demonstration for government use (open to all kinds of motive power)—First prize, gold medal; second prize, silver medal.

Ten-mile mail race—First prize, gold medal, to manufacturer of mail wagon for best time in finishing and making 40 mail-box collections; second prize, $25 in gold, to driver of prize-winning wagon; third prize, gold medal, for most practical and best adapted wagon.

Pulling contest—One prize, gold medal, for best application for motive power of acetyline, alcohol, kerosene, compressed air and liquid air.

Fifty-mile quadricycle race—Cash prizes, first and second.

Great automobile-equestrian race—Being an event in which a running horse will compete with an auto; prize, gold medal.

Pioneer contest—Prize, silver cup, for oldest automobile, steam, gasoline, or electric power, to be exhibited.

THURSDAY, SEPTEMBER 20—Grade-climbing tests—Automobiles will be tested, each in its class of motive power, for greatest per cent. grade climbed from still position, greatest per cent. of grade climbed from flying start, and test of speed climbing 15 per cent. grade, 10 minutes' duration. Tests also on declines. Prizes, gold and silver medals.

One-hundred mile race—For manufacturers using carriages carrying four grown people; prize, silver medal.

One-hundred-mile race—For private owners using carriage carrying two grown people; gold medal. Five-mile ladies' race—Prize, silver cup.

Ten-mile ladies' race—Gold medal.

Ladies' obstacle race—Silver cup.

Three-mile merchandise delivery race—First prize, $50 in gold; second prize, $25 in gold.

Fifty-mile motor racing tandem races—Cash prizes.

Automobile manufacturers' congress at Wellington Hotel at 8 p. m.—Addresses of welcome, etc.

FRIDAY, SEPTEMBER 21.—Ten-mile road race for vehicles carrying four people—Prize, silver cup.

Ten-mile road race for vehicles carrying two people—Silver medal.

Grand sweepstakes event for Inter-Ocean challenge cup.

Five-hundred-mile race, commencing at 5 a. m.

One-mile novelty race—Automobiles running backward. First prize, silver cup; second prize, silver medal. Entries limited, several heats if necessary.

Grand floral parade, 3 p. m.

Fifty-mile motor bicycle race—Prize, cash purse.

One-hundred mile twentieth century race for motor tricycles, motor quadricycles, motor tandems, and motor bicycles—Cash purse.

SATURDAY, SEPTEMBER 22—Ten-mile manufacturers' race for steam vehicles—First prize, silver cup; second prize, silver medal.

Ten-mile manufacturers' race for gasoline vehicles—First prize, silver cup; second prize, silver medal.

Ten-mile manufacturers' race for electric vehicles—First prize, silver cup; second prize, silver medal.

Twenty-mile combination race to respective winners of above ten-mile races—Gold medal.

Five-mile transfer express race—Prize, silver medal.

Fifty-mile consolation race for losers of twentieth century race—Cash prize.

Novelty design contest—Being a contest for designs in automobiles which will depart radically from the carriage type; prize, silver cup.

Gold medal prize for most original conception in an automobile that will still leave the vehicle acceptable and practical.

Grand illuminated automobile parade, 8 p. m.; silver cup for most attractive display.

The amounts of the cash prizes have yet to be decided.

In the utility contests the following ratio has been adopted.

| | Points. |
|---|---|
| Ease of control, noiselessness, etc., to be determined by a two-mile run | 20 |
| Carriage design and practicability | 20 |
| Arrangement of brakes and control of speed | 20 |
| Best hill-climbing power | 10 |
| Best safety device for operating vehicle on grade or level | 10 |
| Best, simplest and most accessible mechanical construction | 20 |

In the heavy draft contests the following ratio has been adopted:

| | Points. |
|---|---|
| Construction | 20 |
| Best motive power | 20 |
| Carrying capacity | 20 |
| Design for practical utility | 10 |
| Control and manipulation | 10 |
| Safety and emergency devices | 10 |
| Power per ton mile—per ton mile to include weight of passengers as well as tare; cost of electricity, gasoline or oil to be based on current market rate of products | 10 |

About thirty manufacturers have agreed to participate and several others are in correspondence with the management in regard to entering. Success, therefore, seems assured.

## SPECIAL PACKARD CARRIAGE.

The accompanying cut shows the latest product of the automobile department of the New York & Ohio Company. The appearance and general design of this machine are the same as the company's standard Packard carriage already on the market. This machine is more powerful, however, and adapted for higher speeds.

A single cylinder gasoline engine, which will indicate 12 h. p. on the brake at its maximum normal speed of 800 R. P. M. is used.

Four speeds ahead are provided, varying from 6 to 30 or more miles per hour, and two speeds backward. As in the standard Packard carriage there are no idle gears in operation, when the carriage is running on the higher speeds. The speed in running is controlled by throttling the engine.

The sparking, which is of the high-tension type, is automatically controlled, a sensitive automatic governor adjusting the spark so that the explosion takes place at exactly the proper point in the stroke for the speed at which the engine is running.

The carriage is fitted with the company's new rim brakes, in which an auxiliary brake rim is fitted on the inside of the rims of the rear wheels, and large brake shoes are applied to this rim, making an exceedingly effective, durable and safe arrangement. Even if the rear axle, differentials and chain should all give way, an efficient brake is still left. The usual band brake on the forward counter shaft is also provided and this is operated with a single hand-controlling lever. The rim brakes are operated by an auxiliary foot lever. Wheel steering is fitted, the makers considering this essential for a high speed machine, although it is probably not necessary for machines designed to run not over 20 miles per hour.

This steering is also fitted to the company's smaller machine as an extra.

All bearings and oil cups are supplied with oil from a single reservoir, and enough oil and gasoline can be carried in the tanks for a run of 150 to 200 miles. Double sets of batteries for the electric ignition apparatus are provided. A detachable dos-a-dos rear seat gives ample room for four or five passengers. The wheels are 36 inches all around, and are provided with four-inch pneumatic tires. The frame is ball-jointed throughout and is extremely flexible, being designed to maintain a high speed on rough roads.

This machine is doubtless more powerful and speedy than is required for general use, but the company believe there is a growing demand for such a machine among experts. It is designed to rank with the high-priced French machines, but is much more simple and better adapted to American roads. The net price complete is $2,000.

## ASSOCIATED AMERICAN MOTORCYCLISTS.

Following the meeting held in Boston, Mass., on August 2d, a second one was held at the Hotel Thorndike on Wednesday, August 22, at which a permanent organization of motocyclists was effected under the name of the Associated American Motocyclists. About fifteen persons were present, and letters were read from almost as many more pledging support.

The following officers were elected: President, C. H. Metz, Waltham, Mass.; vice-president, Kenneth A. Skinner, Boston, Mass.; secretary, S. W. Merrihew, New York; treasurer, E. C. Stearns, Syracuse, N. Y., all of whom were present except Mr. Stearns.

These officers, with five members-at-large, constitute the Executive Committee—the five being Edward Hayes, Providence, R. I., A. L. Adams, Wilsonville, Conn., Frank I. Clark, Baltimore, Md., A. L. Banker, Pittsburg, Pa., Geo. K. Barrett, Chicago, Ill.

A constitution was adopted as appended, a committee was appointed to arrange a run to Newport, R. I., on September 15, in celebration of the organization, a committee was appointed to select an emblem, and a resolution was adopted pledging the organization to use its efforts to cause an observance of all rules and regulations relating to motocycles.

The interest taken in the organization is said to be large, and the outlook for membership good.

Article 1. This organization shall be known as the Associated American Motocyclists.

Article 2. Its objects shall be to promote the general interests of motocyclists; to defend and protect them in their rights on public highways and conveyances; to foster a fraternal spirit between them; and to promote such events as may be considered within its scope.

Article 3. Any reputable motocyclist shall be eligible to membership in this organization upon payment of one dollar initiation fee and an annual membership fee of one dollar, and shall become a member, if his application shall be endorsed by one member or two reputable citizens and approved by the Executive Committee or the sub-committee, thereof.

Article 4. The officers of this organization shall be, at present, a president, a vice-president, a secretary and a treasurer, who, with five members elected from the general membership, and each of whom shall represent a different state, shall comprise the Executive Committee, of which five shall constitute a quorum, who shall devise, direct and decide all matters not covered by this constitution.

Article 5. The annual meeting of this organization shall be held on the third Saturday in June, at such place as in the judgment of the Executive Committee shall be deemed most suitable.

Article 6. This constitution may be altered or amended by a two-thirds' vote of the membership present at any annual meeting.

## THE GOULD AUTOMOBILE STORAGE BATTERY.

The Gould Storage Battery Co., of New York, are manufacturing a special battery for vehicles, which is claimed to have a large amount of active surface and contact between the supporting material and the active material and to be of unusual capacity and durability. The vehicle cell, which is said to give 162 ampere hours at a three-hour discharge rate and 180 ampere hours at a four-hour discharge rate, weighs complete 50¼ pounds, and as composed of 13 plates, 5⅞ x 7¾ inches in size. The normal charging rate is 54 amperes, and the weight of the element alone is 40 pounds.

## AMERICAN BUILT THORNYCROFT STEAM LORRY.

The first Thornycroft steam lorry built in this country came from the Cooke Locomotive Works, Paterson, N. J., for its trial trip on Tuesday, August 21. It was under the personal guidance of Charles D. Cooke, of the well-known engine building company, who has for years taken a keen interest in the motor vehicle, and it gave so good an account of itself that others on similar lines will be turned out as soon as possible, and a new company to manufacture Thornycroft wagons on an extensive scale will be organized by the Cookes and the American agents of the Thornycroft system—Thorpe, Platt & Co., 99 Cedar street, New York.

The vehicle is 17 feet 6 inches long, 6 feet 6 inches wide and 8 feet 6 inches high over all. The platform and underframe are made up of channel irons, so arranged that any desired form of superstructure body can be fitted. The wheels are of a very heavy construction, with metal centers, oak spokes and ash felloes, and are fitted with broad and thick steel tires.

The boiler is of the Thorneycroft patent circular water tube type, with straight tubes. It is fitted with very light top and bottom covers, with special steam joints, to permit easy and rapid internal examination and for the ready cleaning of tubes. The firing of the boiler is central, as in the case of an ordinary kitchen range, the fire being regulated by a hinged ash pan door and the lid of the firebox. The fuel ordinarily used is coal or coke, but provision is made for the substitution of a liquid fuel burner. The working pressure is 175 pounds to the square inch. Two safety valves are fitted, of which one discharges invisibly and silently in the funnel. The other is set 10 pounds higher and discharges directly into the air, thus, if the first fails to act, the second one will at once call the attention of the driver to the fact.

The engine is wholly enclosed with oil bath lubrication, but is so designed that complete access is easily gained to every part. Adjustment is only needed at intervals of from four to six months. A constant lead radial valve gear is fitted, having balanced valves placed below the cylinders, thus giving effective drainage. The engine is suspended from the underframe at three points in such a manner as to be relieved from strain due to any "winding" or distortion undergone by the frame. The engine feed pump is carried and driven by the engine itself, and is of special design to meet the peculiar requirements of road service. The suction and delivery valves of the pump are instantly accessible.

A countershaft is driven by the engine through toothed gearing. It is in three parts connected by a pair of specially designed universal joints, which permit also of a transverse sliding taking place. The joints, being entirely enclosed, are dust-proof and oil retaining, and are provided with large rubbing services, this insuring durability. Between the extremes of no load and a "bump" with full load there is a spring motion of 6 or 7 inches, and this is taken up perfectly by the device described, without interference with the continuous torque exerted on the road wheels and without in any way straining the vehicle. The differential gear is carried on the rear axle. This axle turns in axle boxes, of the locomotive type, attached to the underside of the rear bearing springs. The rear wheels are driven by flat springs attached to the main axle on the "off" side and to the differential gear sleeve on the "near" side, pressing against suitable projections from the felloes. In this way the driving wheel spokes are placed in much the same condition of service as in horse-drawn vehicles, and a yielding connection is obtained between the driving axle and road wheels.

An average speed of seven miles an hour is easily obtained with a load of from three to four tons on the vehicle body. A further two tons can be hauled on a trailer. Two speed gear is fitted, though on good roads a gradient of 1 in 12 can be mounted with the normal or high-speed gear. On occasions when greatly increased driving effort is required the slow-speed gear is used, and this vehicle has carried a load of 3½ tons up a gradient of 1 in 6 without any difficulty.

There is no emission of smoke or visible vapor, no noise of exhaust, and the gearing runs quietly and smoothly. The vehicle is completely controlled from the driver's seat. Water for about 30 miles and coal for 40 or 50 miles is carried. An automatic water lifter and coil of rubber hose is connected to the water tank. In three or four minutes, by its aid, the tank can be filled from any tank or stream by the roadside.

A number of vehicles of this standard pattern have been running in England for the past two years, and are giving the greatest satisfaction. Guinness & Co., the brewers, of Dublin, after using a Thornycroft wagon for 13 months, recently took the engine apart to examine it, supposing that some adjustment would be required, but could discover no appreciable sign of wear.

The new company which will be one of the very first to enter the field of heavy work in the United States will be formed in about two weeks, when full particulars will be laid before our readers. No photographs of the new lorry have yet been taken, but we present a picture of the Thornycroft van now in service in the island of Ceylon, which was referred to in THE HORSELESS AGE of August 22.

THORNYCROFT STEAM VAN IN USE IN CEYLON.

## AUTOMOBILISM AT THE PARIS EXPOSITION.

PART V.

P. M. HELDT.

Fig. 1 shows a light vehicle of the Societé Francaise d'Automobiles. This vehicle, which is shown with the bonnet, covering the motor, removed, is called the "Doctoresse," a name which is probably intended to call attention to its adaptability to physicians' use.

The weight of the vehicle, ready to run, is 880 pounds, and it has a seating capacity of four. It is driven by a 5 h. p., jacketed, vertical Gaillardet engine, which has a single cylinder of 100 mm. bore and 105 mm. stroke, (4 inches x 4 inches). The normal engine speed is 1,200 revolutions per min.

The crank of the engine, like the cam-shaft gears, is enclosed in an aluminum case. The engine is provided with an inertia governor, controlled by hand, which acts on the hit-and-miss principle. The ignition is electric and of jump-spark type, the time of ignition being variable at will. Accumulators furnish the current for the spark.

The engine shaft carries a pulley, from which the power is transmitted by a belt to an intermediate shaft, below the floor of the body, about midway between the front and rear wheels. The pulleys are of aluminum. From the intermediate shaft the power is transmitted to the differential shaft by means of spur gears. Two sets of gears are provided, and two speeds may be obtained—10 and 20 miles an hour. By means of the engine governor any speed up to 20 miles can be had. The differential shaft is chain-belted to the driving-wheels.

The wheels are of bicycle construction, and have pneumatic tires of 2.6 inches diameter. The diameter of the front wheels is 28 inches and that of the rear wheels 32 inches.

The frame is of channel iron, and is supported by four semi-elliptic springs. Steering is effected by a hand-wheel, which is also of aluminum. It may be added that aluminum has been used wherever possible.

The Societé Francaise d'Automobiles build also a lighter vehicle for two persons, on which a 3½ h. p., air-cooled, single-cylinder Gaillardet motor is used. In this vehicle the transmission is by belt to an intermediate shaft, and from this shaft by spur gears to the differential on the driving axle.

E. Rossel, of Lille, exhibits a steam tractor for canal boats. This tractor has a vertical, coke-fired, water-tube boiler of the quick steam raising type, and a double-cylinder horizontal engine of 12 h. p. The two cranks of the engine make an angle of 90° with each other. The admission is variable, from 0 to 80 per cent. of the stroke, and the engine speed can run up to 350 revolutions per min.

The rear wheels are the drivers. They are cast with an internal gear on one side, with which engage the pinions of a differential shaft. The differential shaft is connected to the crank-shaft by several sets of spur gears, which are engaged by means of positive clutches. Two speeds ahead and one reverse are provided. The higher speed is used for towing empty boats and the lower for loaded boats, up canals. The front axle, which is provided with steering spindles for pivot steering, swivels around a pin fastened to the frame, centrally qetween the two wheels. The frame has, therefore, only three points of support, and will accommodate itself to all conditions of road surface.

Two men are required to operate one of these boat tractors, or canal tractors, one for tending the boiler and the other one for steering and controlling the vehicle. It is claimed that the machine exhibited will haul a train of six canal boats, each weighing 200 tons, at a speed of 5 km., or slightly more than three miles an hour, against the stream.

A feature of some interest is the method employed to increase

FIG. 1.—LIGHT CARRIAGE, SOCIETE FRANCAISE D'AUTOMOBILES.

FIG. 2.—STEAM CANAL TRACTOR. E. ROSSEL, LILLE, FRANCE.

FIG. 3.—GILLET, FOREST & CO.'S VOITURETTE.

the adhesion of the wheels to the ground. Both front and rear wheels are wound with heavy rope, as will be seen from the illustration (Fig. 2). This form of tire may have a future, if motor tractors are to be used for hauling trains of merchandise on undeveloped roads in colonies and elsewhere. It has the same good qualities as the rubber tire, of increasing adhesion and of relieving shocks due to the unevenness of the road, though it possesses the latter quality in a lesser degree than the rubber tire.

The light vehicle of Gillet, Forest & Cie., herewith illustrated (Fig. 3), is exhibited at the Champ de Mars. It is propelled by a single cylinder, horizontal motor, placed in front. The motor has a bore of 115 mm., and a stroke of 150 mm. (4.6 inches x 6 inches), and at its normal speed of 800 revolutions per min. it develops 5 h. p. The engine is water-cooled, but no pump is used, the circulation being effected on the "thermo-siphon" or gravity system, quite common in America but rare here. The speed of the engine is regulated by varying the time of opening and closing the exhaust valve.

The engine crank-shaft is placed crosswise of the vehicle, and it connects to a longitudinal shaft by means of bevel gears. The change gears connect this longitudinal shaft to another one, which is geared to the differential on the rear-driving axle by means of a bevel pinion and gear. The vehicle has three forward speeds—6¼, 12½ and 18¾ miles an hour—and one reverse speed. The various speeds are obtained by shifting the gears, which form what is called here a carriage. The second longitudinal shaft connects with the bevel pinion, meshing with the differential gear by a universal or Cardan coupling.

The frame of the vehicle is of drawn-steel tubing, and is supported by four semi-elliptic springs. The wheels have wood spokes and pneumatic tires of 3½-inch diameter.

The vehicle is controlled by means of one steering hand-wheel, three hand levers and two pedals. The hand levers operate one of the brakes, the change gears and the motor control, respectively, while the pedals operate the other brake and the friction clutch.

A perforated sheet metal apron in front of the frame shields the engine from view. A radiating coil is bent around the semicircular side of a metallic case in front, and the water and gasoline tanks are placed inside the seat of the vehicle.

The total weight of the vehicle is 1,000 pounds with water and gasoline. Various forms of bodies, seating either three or four persons, can be used with this running gear.

The majority of French automobiles, of the road vehicle or heavier class, belong to one of two types—those with a vertical motor in front and those with a horizontal motor in the rear. The former type is based upon the Daimler vehicle, and the latter upon the Benz. Vehicles of these two makes, imported into France in the early nineties, served as models for French designers, and although many detail improvements have been made, the general disposition of the parts has undergone few changes, so that when looking upon a frame or running gear with motor and mechanism in place, one can usually perceive the lines of one or the other of the above two vehicles shining through.

The vehicle, of which the running gear with mechanism is illustrated in Fig. 5, is manufactured by the Compagnie Française des Cycles & Automobiles. It resembles, in many respects, the Benz vehicle, only that instead of the belt transmission of the latter it has a spur gear transmission.

The frame is entirely of drawn-steel tubing, and is suspended by elliptic springs in front, and by semi-elliptic springs in the rear. The motor is of the horizontal, single-cylinder type, and is rated at 6 h. p. The crank, cam-shaft gearing and igniter parts are unencased. The method employed to fasten the engine to the tubing of the frame is worth noticing. The engine shaft extends all the way across the frame, and is supported at its extremity by a bearing clamped to the side tube of the latter. The shaft carries four friction clutches, the loose members of three of which are connected to spur gears, and the loose member of the fourth connected to a sprocket pinion. These gears and the sprocket pinion connect with corresponding transmission members on the differential shaft, passing below the cylinder of the engine. From this shaft the power is transmitted to the rear wheels by means of sprockets and chains. The three gears give the three forward speeds, and the chain transmission from engine shaft to differential the reverse speed.

The wheels have steel spokes and pneumatic tires. The sprockets are fastened to the hubs, and are, as usual, cast integral, with brake drums. The case of the differential forms the drum for another brake, which will disconnect the motor the moment it is put into action.

Steering is effected by a vertical shaft with a hand-wheel.

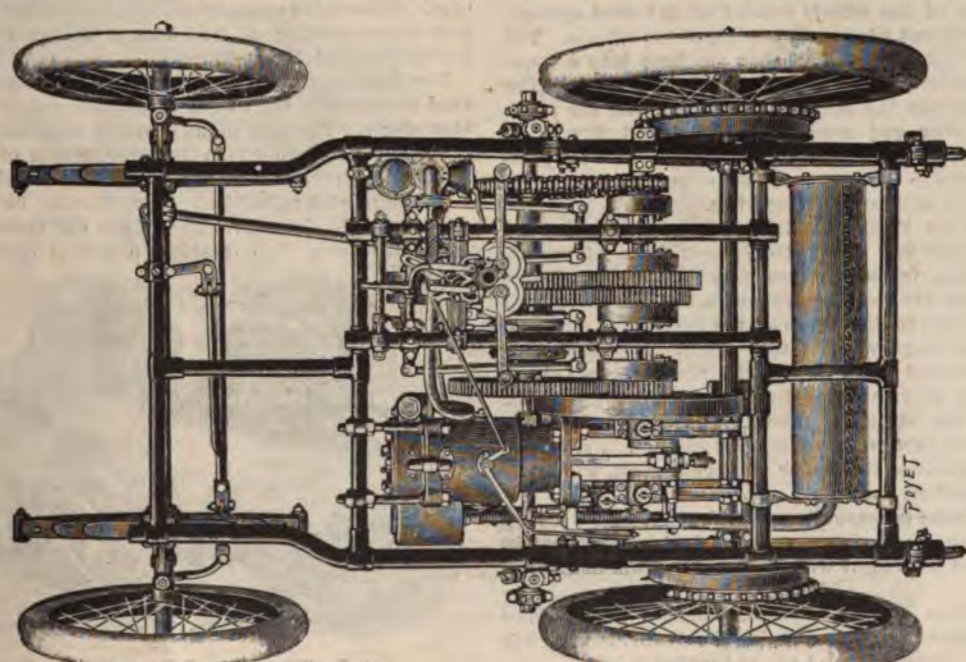



FIG. 5.—PLAN OF THE VEHICLES OF THE CIE. FRANCAISE.

All the operating levers, except one, are grouped around the standard, through which the steering-shaft passes. One of the brakes is operated by a pedal or foot lever, and the other by a hand lever just outside the seat.

The vehicle shown at the Exposition is a duc-spider, seating three persons. It has a sheet metal bonnet in front, the same as vehicles in which the motor is placed in front. Under this bonnet is placed the water-tank, and below it a radiating coil of pipe. A rotary pump is used for circulating the water. The engine has jump-spark ignition, and the sparking point is adjustable while the vehicle is in motion.

The vehicle just described is one of the simplest of the heavier vehicles shown at the Exposition, but the fact that its working parts are all exposed to the dust and grit of the road certainly counts against it. Even the Benz Co., of Mannheim, which so long constructed open motors, now employs aluminum cases to cover the cranks and also the change gears. It may be of interest in this connection to state that a practice which is gaining ground in France is to cover the whole of the machinery by a case with leather panels, fastened on buttons on a metal frame. This cover, although not entirely dust-proof, is fairly so, and besides is very easily removed when it is desired to gain access to any part of the mechanism.

The Compagnie des Automobiles du Sud-Ouest exhibits at Vincennes a three-wheeled vehicle which somewhat resembles

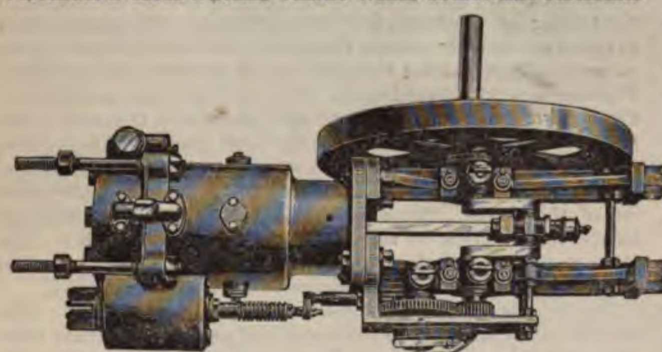


FIG. 4.—"OUFREY" PETROLEUM MOTOR.

the Bollée tricycles and voiturettes. This vehicle is provided with elastic wheels of a novel type, which have pneumatic tires. The spokes of the wheels consist of flat steel springs, braced into the hub and hinged to the rim of the wheels. The spokes leave the hub radial, but they are bent into a loop, something like the form of the spokes of engine flywheels. The flexible spokes replace the suspension springs, and the reach supporting the motor and mechanism is fastened directly to the axles without the intermediary of springs. The suppression of the suspension springs permits to gear the engine to the drive wheels by ordinary spur gearing.

Léon Bollée, of Le Mans, exhibits besides a number of his well-known tricycles and voiturettes, a new form of motor-and-gear-supporting frame for four-wheeled vehicles. Three semi-elliptic springs are used for suspension, one in front, placed crosswise of the vehicle, directly over the front axle, and two in the rear, placed lengthwise of the vehicle. The latter two are united by two steel tubes of rather large diameter (about 2 inches). A tube of very large diameter (3 inches), running longitudinally in the center of the vehicle, connects the front spring and the two tubes uniting the rear springs. From this large tube are suspended the motor and gear case, which are bolted rigidly together.

This form of frame construction would seem to be a step in advance, as the main requirement made of a frame is greatest strength combined with light weight and minimum number of parts.

Two English firms exhibit roller bearings for automobiles and for general purposes. The bearing illustrated in Fig. 6 is that of the Roller Bearings Co., Ltd., of London.

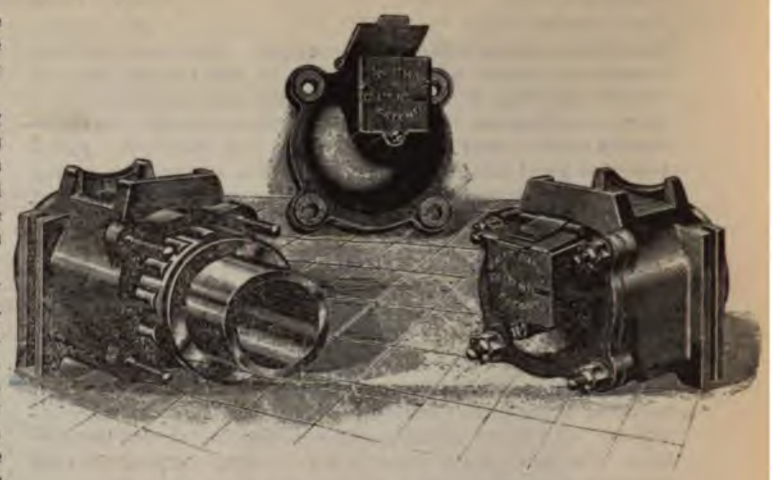


FIG. 6.—ROLLER BEARINGS FOR HEAVY VEHICLES.

This firm states that numerous failures in the application of roller bearings to heavy vehicles have been due to the indentation and wear of the soft steel axle under the hardened steel rollers. To remedy this defect they employ, with their bearings, a carefully tempered steel sleeve, which is shrunk on the axle.

The case of the bearings is of cast iron, reinforced by a steel tube lining. The case can be constructed in any shape to adapt it to various forms of reaches, cross-pieces and springs.

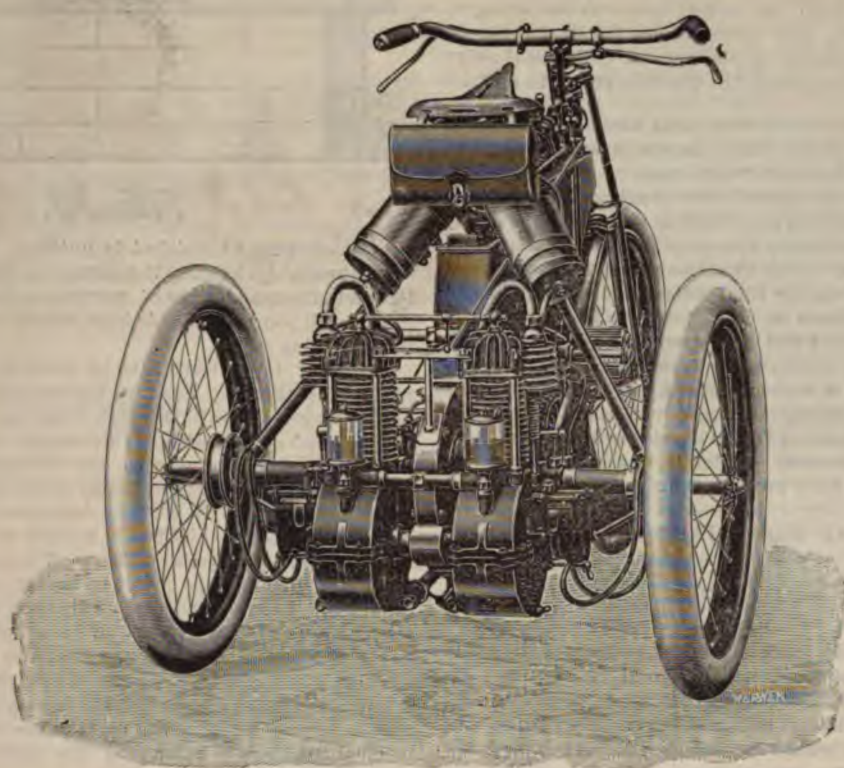
The rollers are of hardened steel. They are held in position by a bronze cage, in such a manner that their center line is kept perfectly parallel with the center line of the axle. The cage turns on the axle, being carried along by the rollers, but it does not carry any of the weight of the vehicle, which is entirely supported by the rollers. At the end of the bearing there is a washer of soft leather, held in position by an iron ring, and serving as a dust guard. Some figures are given in regard to the diminution of starting and traction efforts effected with these roller bearings, but they refer to railroad traction. The starting effort is claimed to be three pounds per ton as against nine pounds with ordinary bearings, and the traction effort from $\frac{1}{4}$ to $\frac{1}{3}$ the effort required with plain bearings. Other advantages claimed are a saving of about 50 per cent. in lubricating oil, and a large saving in the repairs or maintenance of the bearings.

The Mossberg Roller Bearings Co., Ltd., also use that hardened steel shell, a cage with cylindrical rollers and a hardened steel sleeve. The only point in which this bearing differs from the one just described is in the construction of the cage, which will retain the rollers when it is drawn from the shell.

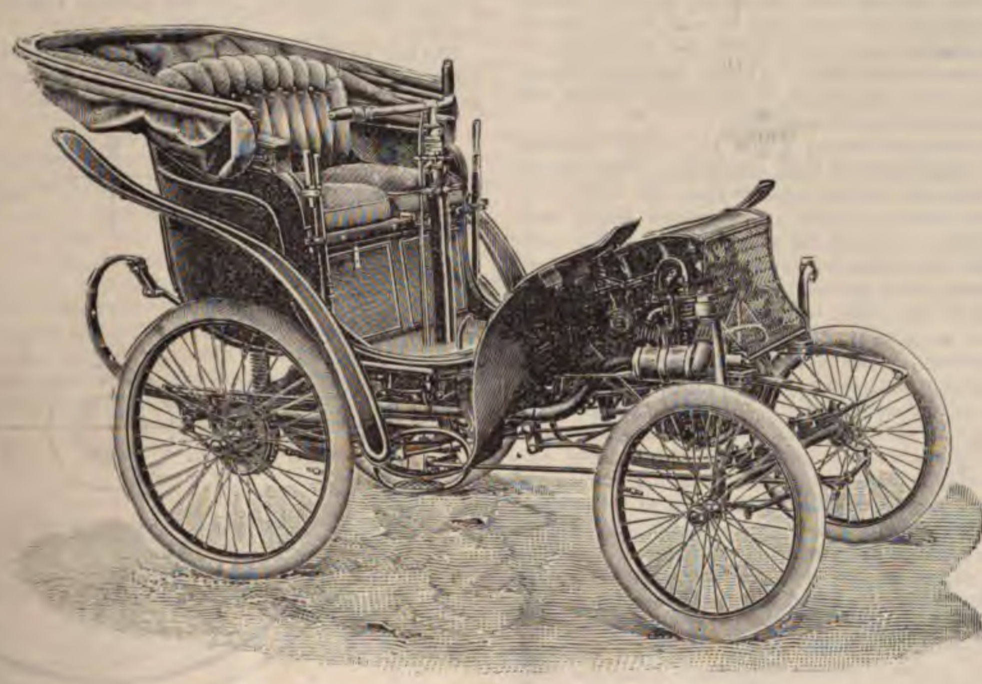
Bearings with cylindrical rollers, like the two just described, do not provide for the friction due to end thrust of the vehicle.

The Mossberg Co. constructs a special end-thrust bearing,

FIG. 7.—"PERFECTUS" BEARINGS AND BURNOUF AND PALLEAU.



TRICYCLE WITH DOUBLE MOTOR EQUIPMENT. PRINETTI & STUCCHI, MILAN, ITALY.



PETROLEUM VOITURETTE. PRINETTI & STUCCHI, MILAN, ITALY.

consisting of a radial cage with tapered rollers, and two hardened steel plates with one coned face, corresponding to the taper of the rollers. For automobiles, these end-thrust bearings are used in addition to the regular cylindrical roller bearings, if it is desired to reduce the traction effort to a strict minimum.

Burnouf & Palleau, a French firm, also have an exhibit of roller bearings at the Fair. These bearings are adjustable, and permit taking up the play which may be caused by the wear of the shells or the axles. The bearings are provided with a two-part shell, having a cylindrical surface on the inside and a double coned surface on the outside. The bearing-box has an internal coned surface on one end and an internal thread on the other. A screw cup for this end also has an internally coned surface, and by means of this screw-cap the play of the bearing can be adjusted, as will be apparent from the illustration. The cage for the rollers is the same as that of the so-called American system of roller bearings, only that instead of the pins of the rollers passing through drill holes in the cage rings, they lie in slots opening to the outside of the rings. Any roller can, therefore, be easily withdrawn and replaced by another one if it should have become damaged.

## PATTERN MAKING FOR GASOLINE MOTORS.

PART IV.

By W. O. ANTHONY.

### PATTERN FOR THE CRANK-CASE.

This casting is preferaby made very light, and on this account cannot well be made of iron, which would be very apt to chill if made under 3-16 in. or ¼ in. in thickness, and thus render the machine work difficult and expensive. Aluminum, aluminum bronze, or plain bronze should, therefore, be chosen for this part of the motor, as none of these is badly affected by being run thin. The writer has cast small crank-cases in aluminum less than ⅛ in. thick.

The making of a pattern of this size and shape, and of such thinness, is a task requiring the greatest care.

The pattern described is for a case made in halves, in which the separating plane is perpendicular to the axis of the shaft. Both halves of the pattern will, therefore, be alike, except that possibly a boss or a light case may be cast upon one for the secondary gear-stud, or the enclosing case for the gears. These, however, may be made as loose pieces upon the pattern, held by dowels, so that one pattern for the body of the case will answer for both sides in the casting.

Having determined the diameter and the width of either half of the case, segments from stuff about ⅜ in. thick should be cut, sawing them out enough smaller than the inside diameter, to turn off ⅛ in. to 3-16 in., and enough larger than the outside diameter to turn off the same amount. The layer of segments at the inner edge, however, must be made about ½ in. larger diameter than the rest of the body of the case, to allow for a flange at this point, to make a broader bearing for the joint. As no machine work is supposed to be done upon the inside or outside of the rim of this case, it must be made large enough inside to clear the crank disks; and shrinkage, particularly in the aluminum, of ⅛ in. for the size most likely chosen, must be allowed for. That is to say, the inside and outside diameter must be ⅛ in. larger in the finished pattern than the casting is intended to be. Having sawed the required number of segments, describe a circle of the correct diameter upon a plane surface, as a guide in building up the pattern. Fit the segments of each layer and fasten by brads partly driven in, as before described for the piston-ring pattern. After all the layers are fitted and numbered upon each segment, to insure returning to the proper position, they should be glued together very carefully, driving back the brads into their original places to prevent slipping. A circular piece of stuff, about 3-16 in. to ¼ in. thick, is now to be glued to the top of the ring thus formed. The pattern at this point will appear as in Fig. 38, showing a section with this part

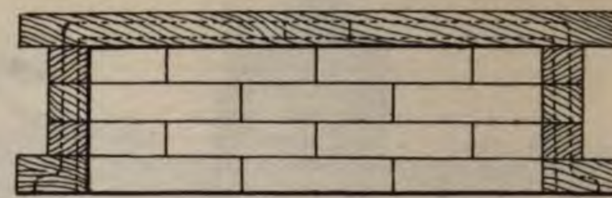


FIG. 38.

of the pattern as finished in outline. Clamp firmly and let dry thoroughly, keeping the pattern upon the same base that it was built upon, pieces of newspaper having been interposed under each joint, upon this base board, to prevent the pattern from sticking to it.

When dry, the pattern is to be mounted upon a wood face-plate, with the inner side out, fastening by 6 or 8 small brads, driven diagonally into the plate from the outside edge. Turn the inside to correct size, giving liberal draft, say ¼ in. to the foot. Care must be taken to get this inside surface straight and smooth. A very good tool for this work is the diamond point made from a file, already described. If the corner at the junction of the side and top is turned rounding, no fillet will be required at this point. Turn off a shaving from the inside of the top, forming the cover, to true it, and cut out the hole for the reception of the hub. This hole may be a very little larger than the hole which is to be cored in the hub. Sand-paper the inside very thoroughly, and drive 6 or 8 brads through the top piece into the wood face-plate. The brads around the outer edge may now be removed and the outside turned to size, being given draft in the same direction as the inside. High speed in turning this pattern is, of course, indispensable.

To turn off the outside face and round the corner, the pattern must now be mounted upon a piece fastened to the face-plate and turned to fit the inside of the case tightly. A few small brads driven through the flange into this piece will suffice to hold the pattern for finishing the outside. The cover of the case should be turned to the desired thickness and the corner nicely rounded, and the pattern sandpapered to a fine surface.

The hub to contain the bearing, or, if the case is of bronze, to form the bearing, should now be put in place. This may be turned outside in the lathe, and glued into place upon the

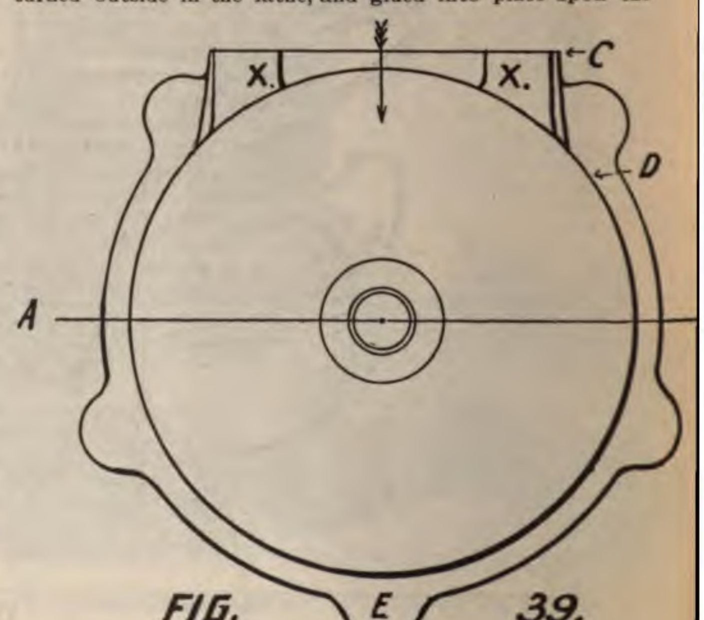
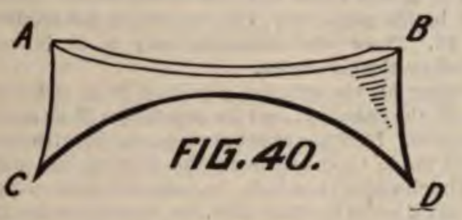



FIG. 39.

pattern and then bored; or it may be bored to the correct taper, and then mounted upon a taper mandrel and the ouside finished. The former is probably the better way.

The opening for the cylinder is now to be cut in one side of the case. This must be cut so that the grain of the cover will run at right angles to the axis of the opening, as in Fig. 39, in which line AB shows the direction of the grain. From a piece a little thicker than the distance CD (Fig. 39), cut a semicircle having a diameter the same as that of the outside of the flange at the bottom of the cylinder, which is to bear at this point. In the back of this piece should be sawed an arc of a circle having the same diameter as the outside of the crank-case. This piece will appear as in Fig. 40, which is a perspective view. In




this figure the straight line AB represents the diameter of the semicircle, and the arc CD is the portion which fits against the body of the case. This should be glued into place after sawing away that part of the flange which would be covered by it. When dry, a semicircle $\frac{3}{16}$ inch less in diameter than the diameter of the lower end of the cylinder, which is to enter the crank-case as a guide, should be described about a point midway of line AB. To saw out this piece, the writer removes the table from the saw, and by holding against the table support the piece may be sawed, under difficulties, it is true, but much easier than it can be cut out with a chisel and knife. The square corner inside must be rounded with coarse sandpaper.

The lugs for the reception of the bolts holding the cylinder and its head in place may now be made. For the sake of lightness, the writer devised a plan to do away with unnecessary metal around these lugs. This consists in making these lugs as loose pieces upon the pattern; and these pieces will remain in the sand when the pattern is drawn, and will be drawn separately into the mold for removal. Fig. 41 shows this idea. The loose pieces are held in position for molding by the pins CC, which are, of course, made fast in the body of the pattern, and fit loosely enough in the lugs, so the latter will drop off of their own weight. The best wayto drill for these pins is to glue the lugs to the body in their correct positions, with newspaper between them and the body to admit of easy removal, and then drill down through the lugs in a line at right angles to the base line AB, Fig. 41. A $\frac{7}{64}$-inch drill and the common parlor match form a useful combination for very much of this fine work, and will answer here admirably. After drilling, the pieces may be removed with a knife very easily, and the pins glued into the body. These lugs must be given draft in every part, to allow of drawing them from the sand. This draft may be slight, and should be in a direction to admit of drawing them, as shown by the arrow in Fig. 39, in which xx indicates the lugs.

The lugs for the bolts to join the two halves of the crank-case together may be as few or as many as desired. Probably five or seven is a good number. One of these should be on the exact center line of the pattern, as at, E Fig. 39, and the remaining lugs spaced off equally on each side towards the cylinder opening, the two nearest this opening being as close to it as possible. Great care should be taken in the pattern to space exactly even from lug E towards each side, as otherwise the lugs will not be in line when the two halves of the crank-case are put together. Except at points at which it is desired to suspend the motor, the writer sees no reason for extending the lugs the entire width of the case, and in practice makes them $\frac{3}{8}$ inch or $\frac{1}{2}$ inch thick, except at these suspension points, where the form using bolts and nuts has advantages which are obvious. In the lighter form of lugs $\frac{5}{16}$-inch cap screws or filister head machine screws serve the purpose of fastening the halves together, and will hold as firmly as bolts and nuts. Inside this pattern a piece should be fitted around the hub for an end thrust bearing for the crank-shaft. Its size will vary with the size of motor being built, but the bearing width should be generous, say $\frac{3}{8}$ inch to $\frac{5}{8}$ inch around the shaft when finished; and its thickness should leave nearly $\frac{1}{8}$ inch of metal to be removed in machining. This piece should, of course, be given plenty of draft in the direction indicated by the dotted lines xx in Fig. 41.

This pattern ought to be thoroughly shellacked as soon as possible after turning, for from its extreme thinness it is very liable to open at the joints, if this is not done. It should finally be shellacked with three or four coats, each coat being allowed to dry thoroughly for at least six hours and then sandpapered.

### PATTERN FOR A SEPARATE MAIN VALVE-CHAMBER.

The object of making a separate valve-chamber is to simplify the machine work and enable it to be accomplished upon a small lathe and without special tools or attachments. Having determined the diameter of the valves, allow over this the thickness of the walls of the chamber and the width of the cooling-ribs. Add to this $\frac{1}{4}$ inch, to obtain the diameter of the block from which to turn this pattern. This will be a split pattern, and the length of the block from which to make it must include a core print at each end. This valve-chamber pattern will appear as in Fig. 42, which is a longitudinal section on the center line, showing the core in outline. The portion at A is to enter the passage in the combustion-chamber. The portion at B receives the inlet-valve chamber, while the lower part at C is cored for the guide for the exhaust-valve stem, which is to be threaded at the same time that the valve-seat xx is turned, thus insuring a true job.

At D a blank is left between the cooling-ribs, for the ignition

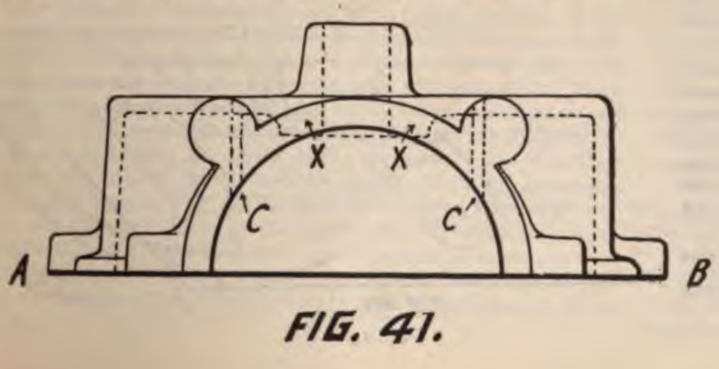



FIG. 41.

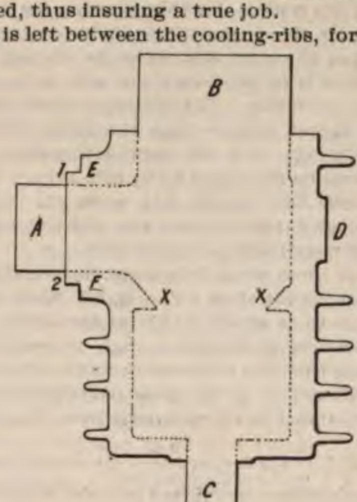



FIG. 42.

plug, and extending to either side of it is a projection for the reception of the stud bolts from the combustion-chamber, which serve to hold the valve-chamber in place. Fig. 43 shows the casting for this valve-chamber looked at from a point at right angles to that in Fig. 42. This figure shows the projections alluded to, for the stud-bolts. The line AB is the parting line in the pattern. The part at x, in Fig. 43, is for the attachment of the exhaust pipe, which in this case is screwed into an opening cored for this purpose.

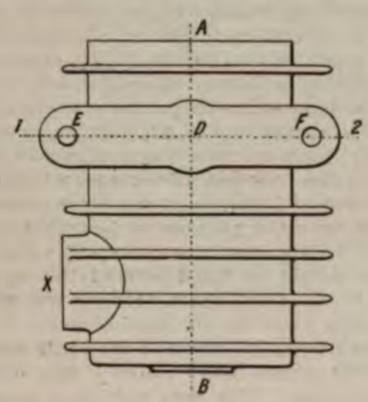



*FIG. 43.*

After gluing together the blocks forming the halves of the pattern, with paper between, and allowing to dry, center the block and turn a cylinder having a diameter the same as the outside diameter of the cooling ribs. Turn the core print for the lower end, allowing it to project about ¾ inch. Turn into the block for the bottom of the chamber, giving slight draft. A slight projection should be left upon this end, of a diameter to allow about 3/16 inch to extend around the finished hole, to form a bearing for the valve-stem guide. Measure from the bottom the distance for the length of the chamber, adding ⅛ inch for machining the top and bottom, and cut this end down for the plain part at the top of the chamber. Turn the core print at this end, about 3/16 inch less in diameter than the opening when finished, and ¾ inch long. Space off upon the middle portion for the ribs, making them as close together as conditions of molding will allow. Turn the ribs as already described for the cylinder. Sandpaper and remove from the lathe. Drill for dowel-pins, one at each end. Before splitting the pattern, it is well to flatten the portion where the part A, Fig. 42, is to go, by cutting down the ribs with a small, sharp chisel, in a circular space, the same diameter as the base EF of the part A. Turn a piece for this part as for a split pattern, since the parting line passes through its center, allow ¾ inch for the length of the print and make its diameter the same as the finished hole is to be, since there will be no machine work required upon the inside. The diameter of the part at 1-2, Fig. 42,* must be ⅛ inch greater than the finished diameter of the hole in the passage into the combustion-chamber, since this guide piece must be machined to fit this hole.

Turn the base EF, Fig. 42, flat upon its under side, to fit against the place flattened upon the valve-chamber. Drill for a dowel-pin through the print and split.

Before gluing these parts into place, flatten the opposite side of the chamber for the strip EF, Fig. 43. This strip, composed of two parts, is to be sawed to about the shape shown, leaving the center portion at D large enough to receive the ignition plug, assuming that the jump-spark method is to be employed. Slight draft should be given these parts from the parting line out. If the chamber is to be of cast iron, the strip EF should

* Although Fig. 1, in the first article of the series, does not show this projection 1-2, we have thought best to reproduce this sketch as drawn, as showing a second and probably a better way of doing the same thing.—Ed.

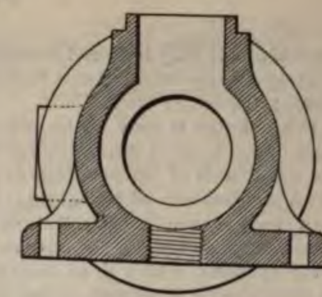


*FIG. 44.*

be 5/16 inch or ⅜ inch thick, and in addition should be reinforced, as shown by the plan view, Fig. 44, which is a section on line 1-2, Fig. 43. These reinforcements may be made, one above and one below the bolt holes.

The opening for the exhaust pipe may be in either side or in the back of the chamber, and its location will be governed by circumstances. In either case the core may be without a print, and simply made to cut through the casting. If made in the back of the chamber, one-half the core will be in either half of the box, but if made in either side, the whole core for this opening will be in the half of the core-box for that particular side. If the opening is to be in the back of the chamber, a place should be flattened there as for the part A, Fig. 42, and the piece turned in much the same way, except that no print will be required. Its diameter must allow about 3/16 inch all around the finished hole when tapped for the exhaust pipe. If this opening is to be in the side of the chamber, as shown in Fig. 43, then that side is to be flattened by cutting away the ribs, and the piece to be turned solid.

After these parts are all ready, the body of the pattern may be split and the various pieces glued to their respective places. It is well to glue the dowel-pins to place first, as, by this method, the parts may be accurately lined at the parting-line. When all are glued to place, the crevices between the ribs under the parts are to be filled with wax and finished off to give proper draft and present a smooth surface. The bolts passing through E and F, Fig. 43, should lie as close as possible to the outside of the chamber.

The core-box for this pattern will be in two parts. The body should be made first, of strips of the proper thicknesses for the various diameters of the inside of the chamber, making both halves exactly alike in this particular. From the end of the print B, Fig. 42, should be measured the distance to the center line of the passage at A, and this distance laid off from the corresponding end of the box down one side. At this point a semicircle should be described, having a diameter the same as that of the print A, Fig. 42. Cut out this semicircle with a gouge, so that a semicircular channel will extend in to meet the body of the box. This half of the box will appear as in Fig. 45, in which A is the channel just described. Cut a similar passage in the other half of the box, but upon the reverse side, so that, when closed, the two channels will form a circular passage. Be very careful to have them register exactly when

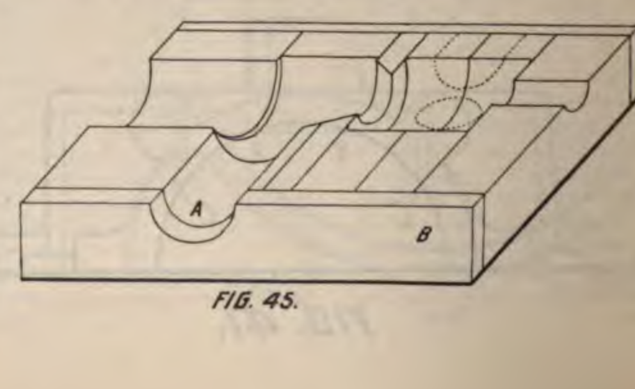



*FIG. 45.*

the box is closed. Cut a semicircle in a piece thick enough to complete the length of the passage, and of the same diameter, as piece B, Fig. 45. If the exhaust opening is to be in the back, a similar semicircular channel must be cut in each half, as shown by the dotted lines in Fig. 45. The length of this passage must be such that the end of the core formed therein will just reach the inner side of the mold at the point flattened for it. Should the exhaust opening be in the side, then a hole, tapering slightly, must be sawed in the bottom of the corresponding half of the box; and the piece sawed out must be planed off until when glued back in the hole, its flat top will form a bottom for the hole, giving it the correct depth to allow the core at this part to just cut through the casting. The dotted lines in the bottom of Fig. 45 give this idea. The box should now have its side and end strips nailed on and the corners waxed slightly, and it and the pattern are ready to shellac.

PATTERN FOR THE INLET VALVE CHAMBER.

If the motor is to occupy a fixed position relative to the source of vapor supply, the inlet valve-chamber described below has many good features and is easily machined. If the motor is to be frequently changed in its position, this will make advisable some form of swiveling valve-chamber, which will admit of the opening being freely turned in any direction after the valve-chamber is screwed to its seat. In the fixed form of chamber, the under side of the flange may be finished, with relation to the threading, so the opening will be in the desired direction when screwed down to its seat. Making separate guides for the valve-stems, while entailing a little more work, possesses several advantages. The guides may be made of steel and hardened if desired, and they may be renewed when worn without affecting the rest of the chamber. The pattern for the fixed form of valve-chamber is shown in section in Fig. 46, which shows also the core in outline. The prints are at A, B and C, A being the opening into which the guide is to be threaded, B the entrance for the vapor and C the opening at the valve seat. The outline of the spring, showing its bearing upon the ledge cored over the valve-seat, is also seen in Fig. 46.

FIG. 46.

Glue together the usual blocks with paper between them, allowing for the largest diameter at 1-2, and the length to include the core-prints at A and C, of $\frac{1}{2}$ inch or $\frac{3}{4}$ inch each. No cooling ribs are necessary upon the inlet valve-chamber. Turn to about the shape shown, leaving enough stock to be machined at the bottom, under the flange at 1-2, both for the flange itself and for threading to screw into the main valve-chamber; also at the top to thread for the guide, the slight projection forming a bearing for the latter. Just above the flange 1-2, Fig. 46, the body of the valve-chamber should be turned larger for a width of $\frac{3}{8}$ inch to $\frac{1}{2}$ inch, and this portion should be flatted hexagonally to receive a wrench for screwing the chamber to its seat. The shoulder for this purpose is shown in the figure.

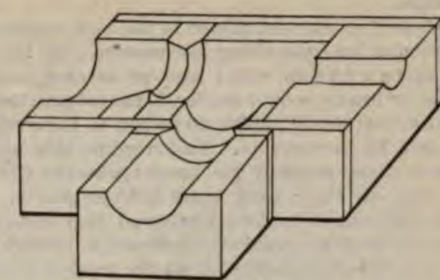


FIG. 47

After turning, drill the ends for dowel-pins and flatten a place for the projecting end B; or the inner end of this projection may be sawed to an arc of a circle having the same diameter as the body of the valve-chamber. Turn this projecting part as shown, leaving stock over the finished size for cutting the external thread at D. This thread is to receive the nut of a union joint.

Drill the print for a dowel-pin and split. Split the body of the pattern and glue the projection B into place. The core-box for this pattern will be very similar to that of the main valve-chamber. One-half the finished box will appear as in Fig. 47. Sharp corners should be waxed in, and the pattern and box are ready to shellac.

## ...COMMUNICATIONS...

### THE COWLES FRICTION TRANSMISSION.

WARREN, OHIO, August 23.

*Editor* HORSELESS AGE:

In your issue of August 15, page 10, I notice with high appreciation a paragraph relating to my invention of an improvement in motor vehicles. This being the disinterested opinion of an expert and entirely unsolicited gives it very great value. There were a few points brought up in this paragraph in regard to the practicability of applying roller bearings to the friction wheels that I would like to explain. The friction wheels are specially designed for roller bearings. For simplicity in the patent drawings a plain bearing only was shown. This plan of friction wheels, embracing a disc between them like a vice, requires only half the pressure to produce a given result, that would be required by any other system.

The leverage between motor and friction remains constant through all changes; that is, if the friction wheels will just hold the motor at periphery of disc, they will do it at the hub; in other systems the pressure at the hub would have to be four times as great. It is not, therefore, necessary for them to work under extra heavy pressure to meet requirements of changing conditions.

The disc has a leverage on the driving wheels of $2\frac{1}{2}$ to 1. That is, it is the same as a disc attached direct to driving axles 40 inches in diameter—(eight inches larger than the driving wheels).

It is reasonable to suppose that frictions of suitable material under favorable and unvariable conditions, can be made to do as much as the drivers. These conditions will, I think, place

the pressure on friction pivots easily within the capacity of roller bearings.

An experienced mechanic, skilled in the art, might observe, that by reason of the controlling mechanism, Fig. 10, working positively up to a certain point and no further, any wear of the frictions, or brake, would render them inoperative, requiring frequent adjustments, which to be left to the average runner could not be thought of. To overcome this objection, I have a patent now pending for means whereby the frictions and brake take up their own wear automatically. That is, when either frictions or brake are released they instantly take up the wear incident to previous application, though it be no more than 1-1,000 of an inch, so that the tension remains constant from the time new friction material is applied until it is worn out.

Yours truly, E. P. COWLES.

## HYDRO-CARBON MARINE MOTOR WANTED TO DISPLACE STORAGE BATTERIES.

BEDFORD, MASS., August 22.

*Editor* HORSELESS AGE:

After having used stored energy in the form of storage batteries for the past 15 years, I have come to the conclusion that the development of light, powerful motors employing some of the fluid carbons either in the form of an explosion mixture in the cylinders direct or as a fuel, would be a great economy of weight, especially in my "Dirigible Torpedo," of which you may have heard. My engine space, at present occupied by cells and motor, is circular, 24 inches in diameter and 76 inches in length, weight of motor 300 pounds, weight of battery, 1,200 pounds.

This handicap of weight, together with that of copperhull and explosive charge, together with the size necessary for that amount of flotation, makes it unserviceable for use on board ship, though answering every requirement for defensive and offensive use from land fortifications in charge of the army engineers.

I desire to develop 18 h. p. on one or two propellers, and should be grateful for any suggestions of compact and efficient types at present on the market that with some slight alterations or additional bevel gearing could be introduced to attain the same power with economy of space and weight without the necessity of having special patterns and castings made.

The Board of Fortifications at Washington has already made an appropriation for the purchase of the device, and while the electrically propelled and controlled torpedo has frequently been tested at Willett's Point, New York (the army station), I have asked for a delay in order to give a weapon of the highest type of propulsion and at the same time secure a naval contract for use on foreign service.

Trusting that I have made myself sufficiently clear. I am,

Yours very truly, NICHOLAS J. HALPINE,
Lieutenant U. S. Navy.

## VIBRATION-PROOF STEERING GEAR WANTED.

SOUTHAMPTON, L. I. August 17.

*Editor* HORSELESS AGE:

Can you inform me if there is a steering gear on the market suitable for steam wagons that will eradicate the vibration which is so annoying and tiresome on rough roads?

JAMES L. BREESE.

[Several hydraulic devices for preventing this have been described in our columns, one brought out by the General Electric Co. We know of no separate attachment that will give the desired relief.—ED.]

# ...OUR... FOREIGN EXCHANGES

## LE GOAZION'S IGNITION.

The best-known system of electric ignition is that used on the tricycles of de Dion and Bouton., It is shown diagrammatically in Fig. 1.

P designates a source of electricity, I is the primary winding of a Ruhmkorff coil and $I^1$ is the secondary winding. R is a flat contact spring, and V its contact screw. C is an interrupting cam, fixed to the secondary or cam-shaft of the engine. At E this cam has a cut out or depression, into which drops the protruding point of the spring R, called the trembler, once for every revolution of the cam-shaft, which closes the primary circuit for an instant. The current starts from the + pole of the battery P; it flows through the primary winding in the direction of the ascending arrow F, through the screw V, then to the contact of the spring P, and returns to the — pole of the battery. At the instant of closing the primary circuit, there is developed in the secondary circuit an induced reversed current, according to the law of Lenz. This current is designated by the descending arrow f. This induced current passes through the central rod of the ignition plug B, and across the gap between the two points of the plug, in the form of a closing spark of more or less brightness, or even as an invisible discharge, according to the strength of the primary current, and then returns to its starting point. At the moment when this inverse spark is produced the hydrocarbon mixture is strongly compressed in the engine cylinder. The heat of the spark is generally sufficient to cause the ignition of the explosive mixture.

As soon as the primary circuit is interrupted by cam C, coil $I^1$ becomes the seat of another induced current, which flows in the same direction as the current in the primary winding, and

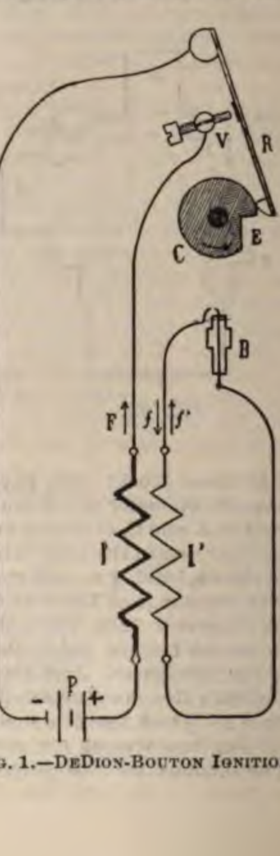



FIG. 1.—DEDION-BOUTON IGNITION.

is indicated by arrow $f^1$, showing in the same direction as arrow F. This induced current flows to the ignition plug, and forms a strong spark at the gap between the two electrodes of the plug. It returns by the central rod of the plug to its starting point. The piston is almost at the end of its active stroke at the moment of the second spark, which latter is, therefore, of no use if the first spark ignited the charge; on the other hand, it occurs too late to act efficiently, as the explosive mixture is no longer compressed, and as the piston is near the end of its stroke.

The production of two sparks, the one inverse and the other direct, succeeding each other at two moments, which correspond to entirely different positions of the piston, gives, therefore, a faulty solution of the ignition question, and prevents obtaining the full benefit from advancing the ignition. If the closing spark, in conjunction with the effect of the compression and the heat of the cylinder walls occasionally produces an ignition, one cannot have a sure advance to the ignition beyond a certain very limited degree, as in basing the ignition only on the "break," or second spark, it is frequently produced by the first spark, during the compression stroke, at a time when the piston is still far from the dead point. As a result of these two entirely distinct effects, the advance of the ignition is, therefore, limited much more than it is generally believed to be, which deprives electric ignition of its greatest advantage.

This difficulty of the double spark has been looked into thoroughly by an inventor, M. Le Goazion, who exhibits in class 27 of the electrical group at the Paris Exposition a new system of electric ignition, in which the make or inverse sparks are suppressed, in order to work exclusively with the break sparks, which are of considerable higher tension than the other sparks. This result is obtained in a simple manner by short-circuiting the secondary coil during the period of each inverse induced current.

This system is shown diagrammatically in Fig. 2. Pi is the battery, I the primary winding, and $I^1$ the secondary winding of the induction coil, B the ignition plug, P the flat spring of the primary circuit, and S the flat spring short-circuiting the secondary coil. C is the ignition cam formed by a cylinder of insulating material, having two different external diameters like two stepped pulleys. It carries at its circumference a primary sector $P^1$, and a secondary sector $S^1$, which are mechanically connected to the shaft of cylinder C, as indicated by the dotted lines. This shaft is in metallic connection with the mass M of the engine. The negative pole of the battery, the beginning of the secondary winding of the coil, and the outer terminal of the ignition plug are also in metallic connection with the mass of the engine, which reduces the number of connecting wires to a strict minimum.

The cam C turns in the direction of the arrow J. The secondary sector $S^1$ is disposed on the cylinder with an angular advance against the primary sector P, so as to get in contact with its spring S, before that the primary sector $P^1$ comes into contact with its spring P. When the cam C turns, the two terminals of the secondary winding are first connected in short circuit by the mass, at the moment when the sector $S^1$ makes contact with its spring S; in fact, the upper terminal is permanently connected to the mass M, and the lower terminal connected to the spring S is now equally in connection with the mass through the shaft of the cylinder. Shortly after this the sector $P^1$ encounters the primary spring P, the circuit of the primary winding is now completed, and the current from the battery Pi circulates through the coil in the direction of the descending arrow F. An inverse induced make current, the direction of which is indicated by the ascending arrow f, is created in the secondary winding $I^1$, but it returns by way of the short circuit, without resistance, which connects its two terminals, without passing the spark plug, which offers, on account of the gap between its terminals, a resistance of more than a million ohms. The rotation of cylinder C continuing, the short circuit of the secondary circuit ceases without producing any electrical effects. A moment later the primary circuit itself is opened and simultaneously the direct, break current is induced in the secondary winding, having the direction of the descending arrow f. The latter flows through the wires of the ignition plug only, since the shunt circuit through the spring S is now insulated—and producing a strong spark at the gap of the plug returns to the secondary coil through the mass of the engine.

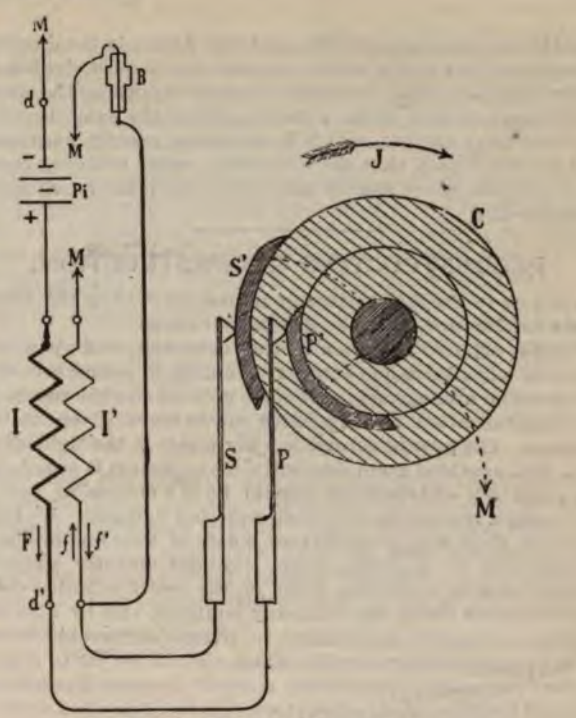



FIG. 2.—LE GOAZION'S IGNITION.

The primary sector $P^1$ must occupy a sufficient angular space on the surface of the cylinder to prolong the time of flow of the primary current. With a too short contact the primary current has not the time to reach a condition of stability, and the induced current is thereby weakened.

To increase the strength of the break spark a condenser may be shunted across the primary circuit by connecting it at the points d and $d^1$, as is usual with Ruhmkorff induction coils.

As will be seen, this system is very simple. It only requires on the cylinder C an additional sector $S^1$ with a friction spring S. If this sector and its spring are suppressed, the operation is exactly the same as in Fig. 1.

This apparatus permits, according to the inventor, to entirely eliminate the make spark, and to produce the ignition of the explosive mixture exclusively with the break spark, the tension of which, as is well known, is very high. The ignition is, therefore, very certain, and the explosion takes always place with mathematical precision at the moment when the contact between the sector $P^1$ and the spring P is abruptly broken. Besides, the advance of the ignition may be carried to much further limits, by varying, as usual, the position of the friction springs, and thus the maximum amount of energy may be drawn from each charge of hydrocarbon, with the maximum economy (*La Locomotion Automobile.*)

[This Goazian igniter is a device for short-circuiting the secondary coil, while the primary circuit is closed by the igniter cam. The idea is that a weak spark is apt to pass at that moment, unless it is somehow prevented, and it is apt to fire the charge prematurely.

We doubt if there is much in the theory. In a coreless coil the E M F induced in the secondary, on closing the primary, is equal, I believe, to that induced when breaking the primary circuit. But when an iron core is introduced, an E M F is in-

duced in the primary coil itself; and this, acting in the direction opposite to that of the battery current, tends to neutralize the latter when the circuit is closed, whereas on opening the circuit the induced current in the primary acts in the same direction as the battery current, which it, therefore, greatly augments. It is for this reason that the secondary, under ordinary conditions at least, gives sparks only when the primary circuit is broken.—Ed.]

## RECONSTRUCTING RECONSTRUCTION.

Apropos of the latest attempt at reconstructing the affairs of the British Motor Co. the *Automotor* says:

"At the original inception of this company, and upon each occasion when there has been a re-shuffling in connection with the financial arrangements, we have pointed out the enormous over-capitalization and excessive advantages given to the vendors. The present scheme is a big stride in the right direction, and, provided good directorial management is appointed, the *bona fide* shareholders should have a chance at last of obtaining a reward for their long-suffering patience. We hope, however, there will be no further waste of time and money in endeavoring to maintain those doubtful 'master patents.' Rather look to protecting some of the really valuable detail improvements which the company controls, and by also proceeding as rapidly as possible to place a serviceable vehicle upon the market, earn profits which should go far to remove the bad impression surrounding most of the past transactions fathered by the original promotors. 'Better late than never.'" If the company can get rid of its promotors, at whatever cost, it may yet become a true factor in the British trade.

## THE BENZ SPIDER PHAETON.

We illustrate below the latest production of Benz and Company, of Mannheim. The vehicle has seating accommodation for four persons; it is fitted with a horizontal engine of 9 h.p. The crank-shaft works in an oil-containing case, while a central lubricator supplies the oil for the working parts. The ignition is electrical, and the cylinders are water-jacketed, the water tank being located in the fore part of the frame. Four speeds forward and reverse motion are provided, the car being, it is claimed, able to maintain an average speed of twenty-five miles per hour. Steering is controlled by a horizontal hand-wheel.

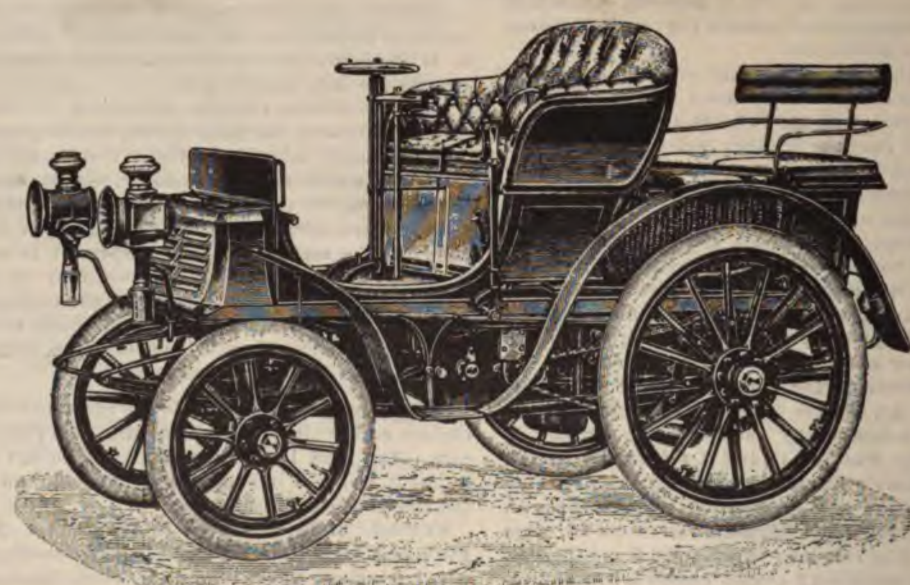
A writer in a London daily thinks that there is no advantage in using motors larger than the popular 1¾ h. p. on tricycles. "Of course," he says, "there is always a great obstacle in the way of higher powered engines, and that is the cooling. A tricycle engine may be taken as nearly always air-cooled, and the present day 2¾ h. p. engines are very liable to give considerable trouble through over-heating, and would necessitate frequent stops on a long journey. The old 1¾ h. p. engines gave a speed far in excess of the limit speed allowed by law, if geared properly and kept in good condition, would climb nearly any hill, and could be driven for long periods without undue heating. A tricycle with a 2¾ h. p. engine is an endless source of annoyance when driving by reason that the normal speed of the vehicle is so great that every effort has to be used to keep anywhere near safety when in a town or a tight place."

It is reported that Lord Carnarvon has purchased for $15,000 the machine with which M. Charron won the Gordon-Bennett cup, which is the same that M. Voigt drove into second place of the Paris-Toulouse *course*.

## THE AUTOMOBILE CLUB'S EXHIBITION.

A. R. Shattuck, chairman of the Exhibition Committee of the Automobile Club of America, states that all the floor space in the Madison Square Garden has been taken by intending exhibitors, and the demand for space has been so great that it has been decided to floor over the boxes on the north side of the Garden and also to exhibit automobiles in the restaurant.

The following manufacturers will exhibit their products: The National Automobile & Electric Co., Riker Motor Vehicle Co., Winton Motor Carriage Co., F. A. La Roche & Co., M. C. de Dion-Bouton Motorette Co., United States Automobile Co., L. M. Harris, The Autocar Co., Foster Automobile Mfg. Co., Automobile Co. of America, Woods Motor Vehicle Co., Stanley Mfg. Co., Locomobile Co. of America, Canda Mfg. Co., American Electric Vehicle Co., Daimler Mfg. Co., Waltham Mfg. Co., American Bicycle Co., Electric Vehicle Co., Overman Auto. Co., The Knox Auto. Co., Holyoke Auto. Co., Jos. Dixon Crucible Co., Diamond Rubber Co., Rose Mfg. Co., Consolidated Rubber Tire Co., Gleason-Peters' Air Pump Co., Goodyear Tire & Rubber Co., Dow Portable Elec. Asst. Co., Chas. E. Miller, Veeder Mfg. Co., B. F. Goodrich Co.



Benz Spider Phaeton.

# MINOR MENTION

On August 25 the Buffalo Automobile Club took a run to Niagara.

The Worcester Automobile Club enjoyed an outing on Sunday, the 19th.

The Stearns Automobile Co., of Philadelphia, was recently ncorporated under Delaware laws with a capital stock of $1,000,000.

The Maltby Automobile Co., 10 Clinton street, Brooklyn, N. Y., have secured the Brooklyn and Long Island agency for the mobile carriage.

W. R. Bullis, master mechanic of the Chatham and Lebanon Valley R. R., recently tested a motor tricycle propelled by a motor of his invention.

At the State Firemen's Parade in Syracuse, N. Y., last week, the marshal and his assistants rode in locomobiles furnished by local automobilists.

The de Dion-Bouton Motorette Co. wishes to enter into negotiation, preferably by personal interview, with reliable parties who will act as agents.

The Electric Vehicle Co. has issued a catalogue showing 17 different styles of electric vehicles, but only one gasoline vehicle—their tricycle carrier.

The American Electric Vehicle Co. obtained the only award given at the Paris Exposition to an American exhibitor of automobiles—a gold medal.

The Bethlehem Steel Co. have discontinued their St. Louis office, and the territory hitherto covered by it will be handled from the Chicago office direct.

The Philadelphia Motor Vehicle Co. has been incorporated under New Jersey laws, with $50,000 capital, by A. L. Kull, Adolph Morris and J. C. Nichols.

The Maryland Automobile Mfg. Co., capital stock $10,000, has been incorporated by J. Philip Roman, Chas. T. Lowndes, H. H. Dickey, A. A. Doub and F. B. Whiting.

The promoters of the *Inter-Ocean* motor vehicle tournament are endeavoring to secure, as a star attraction, a race between Albert C. Bostwick and W. K. Vanderbilt, Jr.

Parker & Burton, the Detroit patent attorneys, have issued a new edition of E. J. Stoddard's valuable pamphlet on "Gas Engine Design," which they are sending free to applicants.

The Wisconsin Wheel Works, Racine, Wis., is said to have received an order to build a large number of automobiles of 750 pounds weight and speeded to a maximum of 12 miles an hour.

The American Bicycle Co. is reported to have purchased the patents, tools, drawings and steam carriage of F. C. Billings, superintendent of the Billings & Spencer Co., Hartford, Conn., and will manufacture under these patents.

The Maryland Automobile Mfg. Co. has been organized with $10,000 capital by Charles T. Lowndes, J. Philip Roman, Howard H. Dickey, Albert A. Doub and F. Brooke Whiting. Shops will be located at Westernport, Allegheny Co., Md.

The Duryea Power Co., Reading, Pa., have equipped an 18-foot launch with one of their regular triple cylinder, 6 h. p. vehicle motors. The motor, weighing 200 pounds, is placed in the rear of the boat, which it is capable of driving at a speed of 10 to 11 miles an hour.

It is announced that the races for the prizes offered by W. K. Vanderbilt, Jr., will take place on September 6, at Aquidneck Park, formerly a race track. The police commissioners, it will be remembered, forbade the events to take place on the Ocean Drive, as was originally planned.

Sidney Dillon Ripley, a wealthy resident of Hempstead, L. I., is endeavoring to prevent the passage of a law restricting the speed of automobiles to six miles an hour within the village limits and three miles an hour in passing other vehicles. He has the support of a large number of his fellow-townsmen.

The Pennsylvania Automobile Club will endeavor to establish the right of automobiles to all the drives in Fairmount Park, the rule at present excluding them from all but one. The formal run to Willow Grove, which was planned for the 19th, was postponed on account of the absence of leading officers.

Last week Postmaster Van Cott, of New York City, made a test with a Hertel gasoline vehicle for the collection of mail. The usual carrier went with the motorman to open the boxes and take out the mail. The first test was confined to the downtown districts, but subsequent trips were made uptown, the results being forwarded to the authorities at Washington.

The E. R. Thomas Motor Co., Buffalo, N. Y., have inaugurated a complete jobbing department, through which they will furnish to the trade all parts that enter into motor cycles. They carry a complete stock of motors for bicycles and tricycles, cylinders, carbureters, frames, gears, aluminum cases, sparking plugs, etc., almost all parts being of their own manufacture.

The Du Bois Automobile Agency, 220 Broadway, New York, have published a little pamphlet explaining the object of their agency, which is described as a bureau of information on all matters pertaining to the automobile. A noticeable feature of the contents is a comparative table of the advantages and disadvantages of the different motive powers, which are very clearly and concisely given.

The Bethlehem Steel Co. are supplying eight forged hollow shafts of fluid-compressed open hearth steel for use in Cuban sugar mills, and are also making a large number of gun barrels for the Winchester Repeating Arms Co. and Colt's Patent Fire Arms Co. These latter forgings are to be made of Bethlehem Nickel Steel, which is peculiarly adapted to the purpose on account of its ability to withstand severe strains.

The New York & Ohio Co., Warren, O., report that their carriages are making good records in the hands of purchasers who have been touring through that section this summer with few but pleasing incidents. Meeting with heavy roads because of a heavy fall of rain, an owner of one of their carriages bethought him of a simple expedient to prevent slipping. He stopped at a country grocery store and purchased some clothes line with which he wound the tires, renewing the line whenever it cut. Runs of over 90 miles are said to have been made without renewing cooling water and no horse accidents have yet been recorded.

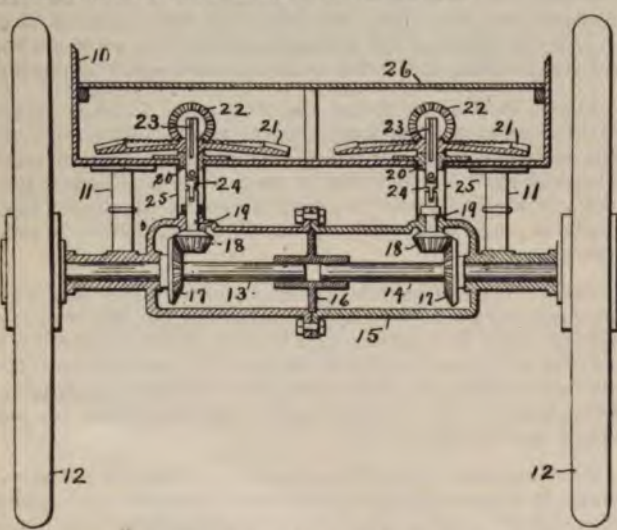
The de Dion-Bouton Motorette Co. have just received word from Paris that, in the recent International Launch Races at the World's Fair, the de Dion & Bouton Company's launches, equipped with their standard type motors, as used on their motorettes and motorcycles, won both contests in which they were entered. In the 50 kilometre contest the launch entered made a record of between 11 and 12 miles per hour. The Motorette Co. propose to make a specialty of motors for marine work with all necessary accessories, etc., and properly fit them to launches, and have ordered out a duplicate set of motors and equipments, which won in the International Races at Paris.

# MOTOR VEHICLE PATENTS ∴ ∴ OF THE WORLD ∴ ∴

## UNITED STATES PATENTS.

655,702—Automobile.—F. G. Frankenberg, of Chicago, Ill. August 14, 1900. Application filed October 23, 1899.

One object of this invention is to provide a closed and dust-proof casing for motors, transmission and batteries (it being an electric vehicle). As regards the batteries and the motor, this is provided for by a false bottom, 26, which covers them. The bevel pinions, 22, are each fast on a motor shaft, and they drive the bevel gears 21, which in turn actuate the pinions and gears 18 17. The latter are enclosed in a shell 15, and flexible tubes 25 protect the bearings of the shafts 19.



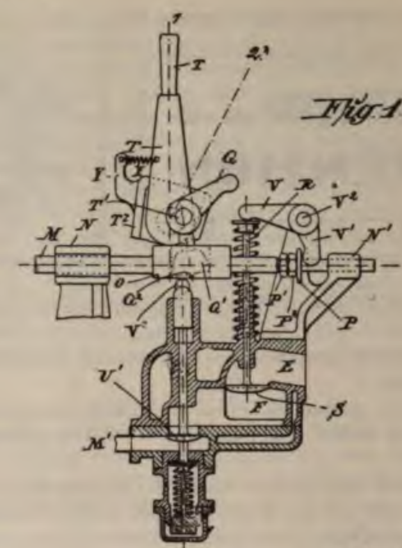
The springs are shown at 11, and the gears 21 are splined on their shafts, to allow for vertical oscillation of the body relatively to the axle. Universal joints, 24, are supposed to take care of lateral oscillations, but it is evident that they will not do this, and that short sections of shaft, having a universal joint at each end, should have been interposed instead.

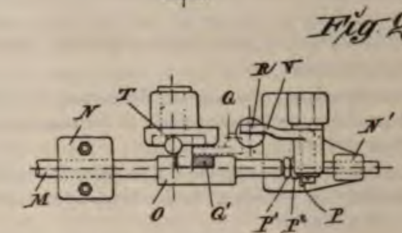
The front wheels are mounted on short steering-axles, the vertical spindles of which carry toothed sectors. Spur pinions engage these sectors, and are connected to move in unison by a sprocket chain passing over sprocket pinions made fast on the shafts of the spur pinions. A block carrying a roller is attached to the chain, and a suitable slotted lever acts on this. As the front wheels must thereby deflect through equal angles, this part of the invention is without practical value.

655,751—Valve Gear for Petroleum Engines.—H. A. Bertheau, of Stockholm, Sweden. August 14, 1900. Application filed January 30, 1899.

This invention comprises an auxiliary valve and operating mechanism, whereby a portion of the burnt gases from the explosions may be stored under pressure in a tank, as required, for the purpose of starting the engine again.

In the drawings, Fig. 1 is an elevation partly in section, of the mechanism involved, and Fig. 2 is a plan view of the same. S is the exhaust valve, opening into the exhaust passage E. $U^1$ is a spring-seated valve carrying on the end of its spindle a contact-roller $V^3$. This valve opens outwardly from the passage F into the passage $M^1$, which leads to the storage tank.





When the pressure in the tank, plus the pressure exerted by the spring, equal the maximum pressure of the explosion, the valve will remain closed.

M is the valve-rod, which makes one reciprocation while the engine is making two revolutions. This rod M is supported in two bearings N and $N^1$, between which bearings it is provided with a forked enlargement O, adapted to move an arm $Q^1$ of a bell-crank lever, which is pivoted at $T^1$ eccentrically on the starting-lever T, said lever T being itself pivoted on a bracket $T^2$ (only part of which is shown). The lever, shown in the position of normal running of the engine, is held in such position by means of a spring X, attached to a protection Y on the supporting-bracket $T^2$. The rod M also carries a plate P, adjustable along said rod by means of nuts $P^1$ and $P^2$, and which acts as a tappet on an arm $V^1$ of a second bell-crank lever, which latter is pivoted at $V^2$ in a suitable bracket. The other arm V of this bell-crank lever acts as a tappet on the spindle R of the exhaust-valve. The fork O moves the arm $Q^1$ of the bell-crank lever back and forth and imparts an equal motion to the other arm Q thereof. When the starting-lever T is thrown over from position 1 to position 2, both of the arms $Q^1$ and Q are lowered, the bell-crank being pivoted on the starting-lever T eccentrically, thus allowing the protection $Q^2$ on the arm $Q^1$ to fall into the path of the roller $V^3$, controlling the pressure-gas outlet. At the same time the arm Q is in a position to act as tappet on the exhaust-valve spindle R.

The operation is as follows: In starting the engine the fly-wheel is turned by hand, so that the piston is in a position to begin its outward stroke. The starting-lever T is then thrown from position 1 to position 2, which lowers the relative positions of the arms Q and $Q^1$ of the bell-crank lever, and the valve $U^1$ is depressed by reason of the projection $Q^2$ coming in contact with the roller $V^3$ on the end of the spindle. Gas under pressure is thereby admitted to the cylinder through the passage F and the piston is driven out. The rod M, continuing its motion—say to the left—will move the arm $Q^2$ in the same direction, turn the bell-crank and cause the arm Q to strike the spindle R of the exhaust-valve S, and allow the expanded gas to exhaust through the passage E, the piston being on return

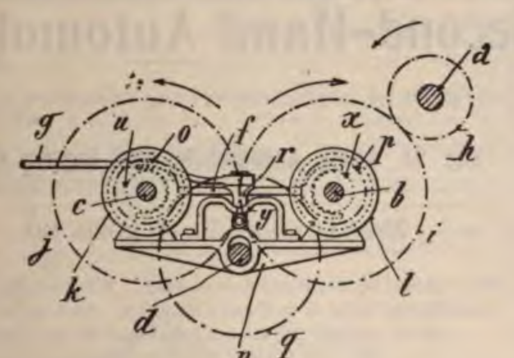
stroke, thus completing a two-stroke cycle. The valve-rod then makes its return stroke—say moving to the right—the end of the arm $Q^1$ traveling with it. The projection $Q^2$ again operates the valve $U^1$ and admits a second supply of gas under pressure to the cylinder, as above described, and the piston starts on its second stroke, while by the time the valve-rod is about completing its return stroke the piston is on its second return stroke. At this time the disk or tappet P engages the arm $V^1$ of the second bell-crank lever, and causes the arm V to contact with the spindle R of the exhaust-valve S, exhausting again through E, completing another two-stroke cycle. The engine is allowed to work in this manner until it has acquired sufficient speed to run as a four-stroke-cycle engine, when the lever T is released and returned to position 1 by the spring X, when the bell-crank Q $Q^1$ will be thrown out of effective operation, thus producing a four-stroke-cycle engine.

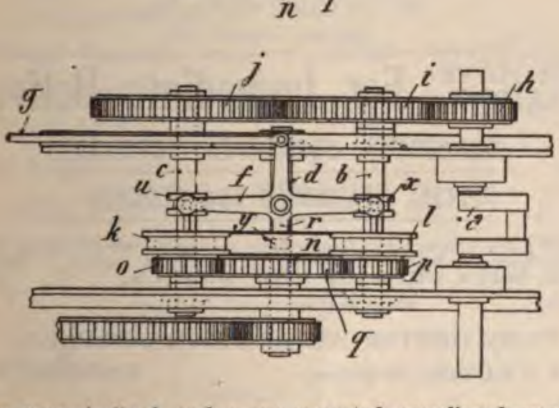
The above can hardly be called an efficient method of compressing the stored gas, inasmuch as the volume, for a given pressure, of the burned gas, when cooled is no greater than that of the unexploded mixture at the same temperature and pressure. The gases discharged into the tank will, therefore, shrink in cooling to about a third or a quarter of their volume at the moment of discharge.

655,690—Traction Engine.—Raoul Coutant-Dujour, of Paris, France, assignor of one-half to E. Salanson, of same place. August 14, 1900. Application filed February 9, 1899.

This invention comprises one speed-transmission gearing and reverse by which explosion motors may be used to propel traction engines.

The crank-shaft *a* of the motor *m* is provided on the side opposite the flywheel with a toothed pinion *h*, which through gearing *i* transmits the movement to an intermediate shaft *b*. The same gearing *i*, by means of a second wheel *j* of the same diameter, transmits the movement to a third shaft *c* in such manner that the two shafts *b* and *c* are rotated in contrary direction, as indicated by the respective arrows, Fig. 1. On




these two shafts *b* and *c* are mounted coupling-drums or clutches *k* and *l*, which are loose thereon, as well as pinions *o* and *p*, which are also connected to the coupling-drums. These pinions *o* and *p* serve to transmit the movement to the vehicle in one or the other direction, according as one or the other pinion is coupled to its shaft by means of a central wheel *q*, secured to a shaft *d*, which also carries at one end another pinion *s*, geared to the toothed rim or wheel *t*, secured to the road-wheel of the vehicle.

The intermediate pinions *o* and *p*, with their shafts *c* and *b*, are alternately coupled by means of a double-pivoted lever *f*, worked by a hand-lever *e* and rod *g*, in such manner that as the arms of the lever *f* are moved in one or the other direction by means of the hand-lever *e* so one or the other of the two intermediate pinions, *o* and *p*, is coupled to the center driving-shaft, whereby the road-roller is made to advance or to move backward, as the case may be.

When the lever *f* is so placed as to uncouple both pinions with a view of stopping the vehicle, the lever *f*, which is provided also with the prolongation *r*, acts on the boss *y* of a brake, the shoes of which press against the outside of the coupling drums *k* and *l*.

The brake comprises a balance lever *n*, provided at each end with a brake-shoe and traversed by the shaft *d*, which passes through a vertical slot, so as to allow of a vertical displacement of the said lever *n* relatively to the shaft *d*. On this balanced lever is fixed a stirrup or bracket *y*, provided in the central part with a shoulder or bend projecting downward, on which operates a roller arranged at the end of the arm *r* of a lever *f*, which is suitably curved. When one or the other of the gear-wheels is in operation the roller of the lever-arm *r* will be in one or the other raised portions of the stirrup, and consequently the double brake will be out of operation with the operating-lever *g* in the middle position, the gears *k* and *l* are uncoupled, while the balanced lever *n* rises, owing to the roller of the lever-arm *r* being brought under the projecting bend of the stirrup, and the brake-shoes are pressed into engagement.

655,709—Vehicle Wheel.—F. M., J. S., and W. W. Hilton, and R. M. Merriman, of Akron, Ohio. August 14, 1900. Application filed December 26, 1899.

A solid rubber tire having stays or stiffness of crimped wire embedded in its base, the stays being crimped in a plane radial to the center of the wheel. A suitable channel-iron for the rim, having one in-turned and one out-turned lip, and a binding-wire to pass around a lip molded on the tire just within the out-turned edge of the channel-iron, are included in the patent.

655,749—Power Mechanism, for Automobile Vehicles.—E. E. Allyne and Le Dru R. Pomeroy, of Cleveland, O. August 14, 1900. Application filed July 17, 1899.

This invention comprises a system of transmission by friction cones, after the manner of the Evans' cones, having suitable mechanism for adapting this system to vehicles. The cones are disengaged by shifting the driven one on its axis till it no longer grips. The friction ring running between the cones is caused to shift or traverse from one end to the other by a forked guide, carried on a nut. A long screw, parallel with the axes of the cones and running in this nut, is rotated when desired by friction, pulleys from the shaft of the driving cone, and the nut thus made to traverse, carrying the ring with it. Reversing is accomplished by gears swung into or out of mesh.

655,853 —Motor Vehicle.—P. J. Collins, of Scranton, Pa., assignor to the Collins' Electric Vehicle Co., of same place. August 14, 1900. Application filed February 15, 1900.

A steering mechanism, in which the attempt is made to combine fifth-wheel steering with stub axles for the wheels. The front axle swivels on the king bolt and the short steering axles swivel on the main axle. Both wheels are deflected through the same angle, and the inventor tries to combine irreversibility with a short range of movement of the steering lever.

655,943—Sprocket Wheel.—E. S. Williamson, of Pittsburg, Pa. August 14, 1900. Application filed January 10, 1900.

A sprocket wheel with inserted teeth.

656,101—Explosive Engine.—O. J. Fairchild, of Jamestown, N. Y. August 14, 1900. Application filed August 25, 1899.

A pendulum-governing device for stationary engines.

656,020—Gas Engine.—C. Hautier, of Paris, France. August 14, 1900. Application filed November 9, 1899.

A gas engine having an auxiliary combustion chamber in the cylinder head, closed by a large valve with a screw-threaded stem. The upper end of the stem is conically enlarged, and seats like a valve when the stem is screwed in as far as it will go. By this means leakage around the stem is prevented. The object of the auxiliary combustion-chamber is to make the compression lighter when desired.

## BRITISH PATENTS.

12,619 of 1899—Oil and Gas Engines.—A. Barron, of Leicester, and J. J. Ridley.

This invention relates to improvements in oil and gas engines, more particularly to the means employed for vaporizing the oil and igniting the vapor in an oil engine, and also for igniting the charge in a gas engine. Sectional views of the arrangement are shown in Figs. 1, 2 and 3. In its application to an oil engine the jacket A of the vaporizer is attached to the end of the cylinder B by means of bolts. Inside the jacket A there is an inner chamber C formed integrally with the jacket as shown. The inner chamber C has an outlet $C_1$ communicating with the combustion chamber or cylinder B through the end of the jacket A and an opening $C_2$ by which oil is supplied to the vaporizer, opposite to an opening $B_1$, passing through the jacket $B_2$, of the cylinder B. An igniter is fixed in the central ear part of and extends into the chamber C. As it is desirable to regulate or control the mixture between the combustion chamber or cylinder B and the inner chamber C of the vaporizer, a valve H is provided, movable to and fro across the opening $C_1$ to close the latter during the compression of the charge, *i. e.*, approximately during one-fourth of the cycle. The mechanism for actuating the valve H consists of a cam K fixed on the shaft $K_1$ of the engine. The bracket L is provided with a boss $L_1$, to which is pivoted by the bolt $L_2$ a bell-crank lever M, its lower horizontal arm carrying a runner $M_1$, which rides on the periphery of the cam K. The upper vertical end of the lever M bears against and actuates the end of a bolt N, which passes inward and engages the valve H. To secure the return of the valve H after it has been pressed inward by the lever M., a coil spring O surrounds part of the rod N, and is compressed at each inward stroke between the collar $N_1$ and the face $P^1$ of the recess $P_2$ formed in the gland P. The gland P passes through the jacket $B_2$ of the cylinder into the jacket A of the vaporizer, and a collar $N_2$ on the rod is shaped to fit the end of the gland at each outward stroke of the valve, *i. e.*, when a charge has been ignited. The outward end of the vaporizer is enclosed by a cover Q, which may be hinged at $Q_1$ to the flange $A_1$. An opening R is formed in the cover (see Fig. 1), so that a lamp or any other means may be applied to heat the vaporizer or charge when starting the engine. In working, the piston moves forward in the direction of the arrow (Fig. 1), and takes in a charge of air through a port $B_3$ and air valve $B_4$ opened by any desired means, and at the same time the oil valve (not shown) will open to allow a charge of oil, and also a percentage of air to pass through the openings $B_1$ $C_2$ into the chamber C and cylinder B; and as the piston returns it compresses the charge of air and oil vapor, but the valve H being closed during the return stroke of the piston, the said charge does not enter the chamber C until the piston has approximately reached the end of its return stroke, when the valve H opens and allows the charge to enter the chamber C, when it is fired by the igniter and forms the power for driving forward the piston to complete the cycle. For a gas engine the jacket A is not required, the chamber C being open to the combustion chamber or cylinder of the engine.

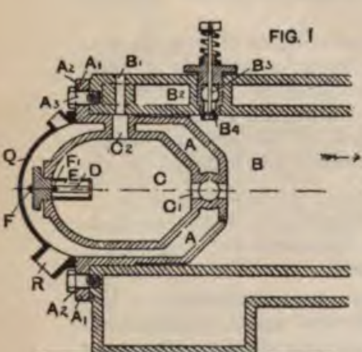


FIG. 1

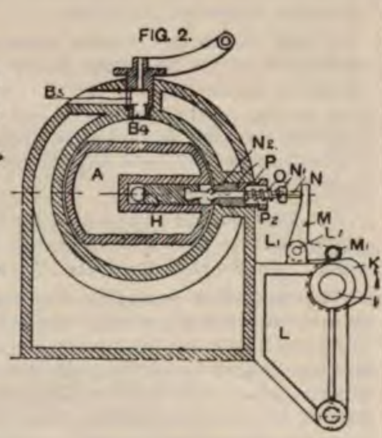


FIG. 2.

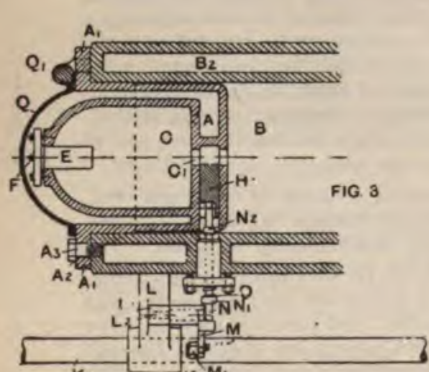


FIG. 3

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An outfit that will run and keep on running.

**Price of Boiler, $165.00 net.**
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**Both f. o. b. Boston.**

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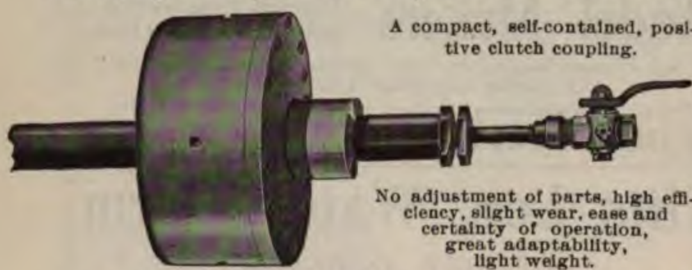

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STEERING KNUCKLE, 1-6 SIZE.

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# EMPIRE BALL-BEARING AXLE

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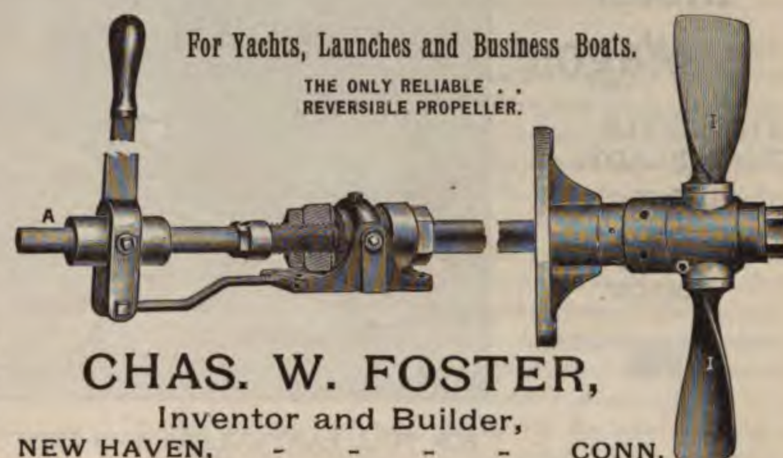


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# THE HORSELESS AGE

...EVERY WEDNESDAY...

Devoted to Motor Interests

VOLUME VI NEW YORK, SEPTEMBER 5, 1900 NUMBER 23

## THE HORSELESS AGE.

E. P. INGERSOLL, EDITOR AND PROPRIETOR.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

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Entered at the New York post office as second-class matter.

*On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.*

## DEATH AND DISASTER IN WEAK STEERING GEAR.

The two accidents, of which an account is given in another column, together with the recent fatal accident in England, in which a motor carriage turned a somersault, owing to a pin having dropped out of some part of the steering mechanism, clearly show to what extent the safety of an automobile depends upon a properly constructed and reliable steering gear. The importance of an absolutely trustworthy gear is, of course, the greater, the higher the speed of which the vehicle is capable, but even at what would ordinarily be considered medium speeds, from 12 to 15 miles an hour, it is essential to the safety of the passengers that such a thing as breakage or disconnection of any part of the steering mechanism should be a practical impossibility.

There are very severe strains on all the parts of the steering mechanism, when the vehicle is running over rough roads, and a liberal factor of safety should, therefore, be allowed in the design of the connecting rods and links of the gear. Another point of importance is that the number of parts by which the pressure of the hand is transmitted from the handle bar or hand-wheel to the wheels be the least possible, because the smaller the number of parts, the less the probability of a derangement in the whole. No connections should be used which are not absolutely reliable under the trying conditions of road service. Thus, for instance, taper pins, depending for their hold upon the friction between them and the parts they connect, are entirely out of place on the steering mechanism of automobiles. Screw connections, wherever used, should be made positive, preferably by the employment of split pins.

The use of irreversible steering gears is, of course, not essential to safety at ordinary speeds, while it is considered so for racing vehicles. However, the smaller the lever arm, through which the wheels re-act on the steering handle, the less are the strains on the intermediate parts, and the less the chances of anything giving out.

## THE AUTOMOBILE CLUB'S SHOW.

Prospects for the complete success of the trade show which is to be held in Madison Square Garden, New York, in November, are most flattering. Nearly all the available space, even to the restaurant and the boxes, never before so utilized at exhibitions, has been allotted, and applications for space are still coming in. With all its spaciousness the great amphitheatre will not be big enough to accommodate the infant industry.

At this particular period in trade development, a thoroughly representative exhibition, conducted on the broad conservative lines laid down by the club's committee, will do much to purge and strengthen the industry. It is of the utmost importance, therefore, that all makers of vehicles and parts should participate. The few who have neglected to secure space should lose no time while there is a nook or a corner left.

## PREJUDICE ON THE WANE IN THE RURAL DISTRICTS.

It is gratifying to learn that the farmers in many sections of the country are taking a very sensible attitude toward the automobile. Recognizing it as the inevitable, soon to be as common on our roads as the horse vehicle, they are improving every opportunity to accustom their horses to it. Two

gentlemen, who toured through Vermont recently in an automobile, report that the farmers they met out driving en route asked them to stop the automobile and give their horses a chance to approach the machine and so overcome their fears. This is a very hopeful sign, and proves that more than half the battle for the automobile in the rural districts is already won. Prejudice has waned; the right of the new vehicle to the road is now generally admitted.

## RETAILERS' POLICY.

One of our esteemed subscribers, who is the proprietor of a flourishing retail automobile business in Central New York, writing of business prospects and methods, condemns the custom prevalent in the bicycle and other trades, of taking old machines in part payment for new models, and expresses the hope that this evil will not take root in the automobile business. The subject of the retailers' policy has as yet received little attention, because of the newness of the industry, but it would seem that the excellence of the demand and the substantial character of the business render imitation of the loose methods of other and older trades worse than folly. Over-anxiety to sell vehicles may lead the dealer into mistakes which, while increasing his sales, will decimate his profits and add to his expenses. It is better to do a smaller business on uniform and correct principles than to sacrifice profits and principle in the effort to monopolize the automobile business of one's town.

## CHARGING AUTOMOBILE BATTERIES FROM SERIES ARC CIRCUITS.

In the operation of private electric vehicles, occasions arise where it is desirable to charge the batteries from series arc circuits.

There are no special difficulties connected with the charging of storage batteries from arc circuits; on the contrary, the automatic regulation of the current in such circuits permits of completely charging an ordinary automobile battery without giving it any attention whatsoever. A number of special precautions must, however, be observed in making the connections to the circuit, and when switching the battery out.

The majority of series arc generators are series wound machines, a type which otherwise is not used for charging purposes. When a battery is connected in the circuit of such a machine, while it is at rest it will be found on starting up the dynamo, that its polarity is reversed, and that the current is flowing through the battery in the wrong direction. We suppose here that the battery was connected to the generator in such a manner that the current would have passed it in the right direction had there not been a reversal of polarity. The only way of connecting a storage battery to an arc circuit, and obtaining a current through it in the right direction, is to connect it when the machine is running, and producing a higher electromotive force than that of the battery.

The two terminals of the battery are connected to points on the arc circuit, close together, and after these connections have been made, the arc circuit is interrupted, the two operations following each other as close as possible. The connections and the interruption of the arc circuit have to be effected by switches, an ordinary double-pole switch and an arc switch serving the purpose well. The levers of these two switches can be mechanically connected, so that their operation must be simultaneous, or they may even be built as one apparatus, but there are no such devices on the market at present. For ordinary purposes one of each of the above-mentioned instruments will suffice, as by placing them side by side, one can be operated by each hand. Incidentally it may be mentioned that the series arc circuits, here referred to, all carry a dangerous voltage, and that motor vehicle owners desiring to charge batteries from such circuits would do well to leave the work of connecting, etc., to the attendants of the station.

## OUR SPECIAL NOTICE DEPARTMENT.

In its particular line of bringing together parties who have small wants to satisfy the Special Notice department of THE HORSELESS AGE is doing a good work. Any who have second-hand carriages to sell or exchange, factories to sell or rent, or those who wish to be brought in touch with engineers or specialists, in any branch of this new industry, are advised to make use of this department. No better evidence of the circulation and general standing of a trade journal could be asked than the results obtained from this class of advertisements.

Our Special Notices produce results, showing that they are read as carefully and regularly as other portions of the journal. Try it and you will find that we reach far and wide.

## MOTOR AGRICULTURAL MACHINERY.

Not the least interesting of the American exhibits at the Paris Exposition was the motor mower shown by the Deering Harvester Co., of Chicago, Ill. This forerunner in agricultural improvement, we are informed, has been thoroughly tested by the manufacturers in the roughest kind of service, and has acquitted itself well. All that is required to make such machines commercial apparently is a further popularization of the petroleum motor, which is employed to propel them. At the present rate of growth of interest and knowledge, the petroleum motor mower should be a saleable article in a very few years. Makers of agricultural machinery who have had sufficient foresight to realize the great change which is coming, and have passed through the necessary experimental stages, will surely reap the fruits of their enterprise.

His Royal Highness, the Prince of Wales, has at last been seen to ride in a motor carriage, and the only straw that lay in the way of a complete conquest for the new vehicle among England's fashionable set has apparently been removed.

Any of our subscribers who are willing to solicit subscriptions for THE HORSELESS AGE from their fellow townsmen are requested to communicate with the Editor, as we are desirous of entering into business relations with such parties.

## AUTOMOBILISM AT THE PARIS EXPOSITION.

PART VI.

BY P. M. HELDT.

In Fig. 1 is shown an electric automobile exhibited in the Austrian section in the Transportation Building at the Champ de Mars. The vehicle is exhibited by Jacob Lohner & Cie., a firm of carriage builders of Vienna, but the electrical parts were constructed by the Vereinigte Elektrizitaets Gesellschaft of the same place. The peculiarity of the vehicle resides in the motors, which are placed in the hubs of the steering wheels, and are of an extraordinary slow speed.

The armature of the motors is fastened to the hub of the wheel, and the stationary field is fastened to the axle. The speed of rotation of the wheels is, therefore, the same as the speed of the motor, and attains in the type illustrated 150 revolutions per minute. In order to keep down the width of the motor, the commutator is placed inside the armature, so that the width of the armature winding constitutes the whole width of the motor.

The motors have each 2½ h. p. normal capacity, but it is claimed that they will work up to 7 h. p. for short periods. The battery contains 44 cells, and may be charged directly from any 110-volt circuit. The company also builds larger vehicles, on which two 5 h. p. motors are used. The latter are built for 200 volts, and the batteries require to be charged from corresponding circuits. The wheels are tired with pneumatics, and the vehicle has a trim and mechanical appearance.

In the background of the photograph is seen an historical gasoline vehicle, built by a Vienna man in 1875. The vehicle has a turning fore-carriage steering gear, a single cylinder engine, a single speed-belt transmission from engine shaft to driving axle, no differential, and is a model of simplicity in every respect.

There are a number of historical machines to be seen in various sections of the automobile exhibit. In the German section, at Vincennes, is shown the first Benz gasoline tricycle, with a single cylinder engine, the shaft of which is placed vertically, an arrangement which was probably adopted to make room for the large flywheel with which the engine is provided.

In the French section at the Champ de Mars there are a number of historical vehicles, exhibited by the Musée Centennale des Voyages et du Tourisme, including a Bollée steam 'bus of 1873 and a steam tricycle built by Roger L'abbe de Montais in 1885; also a De Dion steam tricycle of 1885, a steam 'bus of Amedée Bollée of 1885, and the first De Dion gasoline tricycle. The air-cooled motor of the latter looks rather insignificant when compared with the motors with which the De Dion tricycles are equipped to-day.

Two of the most prolific French writers on automobilism and allied subjects, M. Baudry de Saunier, editor of *La France Automobile*, and author of "A Theoretical and Prac-


ELECTRIC CARRIAGE WITH HUB MOTORS.

tical Treatise on Automobiles," and M. Louis Lockert, editor of *Le Chauffeur*, and author of a volume on automobiles, have collections of their bound works on exhibition.

In addition to complete vehicles, there are shown at the Exposition many detail parts of automobiles and automobile motors. Some of the more noteworthy of these will be briefly described.

One of the novelties in the section of light motors is the Ravel Intensive Motor, which has already been partly described in THE HORSELESS AGE. At the Champ de Mars this motor is shown, fastened down to an iron support, and at Vincennes it is shown in place on a vehicle frame.

The engine has two cylinders and four pistons, and is, therefore, of the balanced type. The crank is located centrally below the cylinders. The cylinders are closed on both ends, and the spaces between the pistons and cylinder heads form pump chambers, while the space between the two pistons forms the explosion chamber. While the pistons are moving towards the center of the cylinders, air, or rather explosive mixture, is drawn into all four pump chambers, and during the next or outward stroke this mixture is forced into one of the cylinders. As the total displacement of the pistons in the pump chambers is double the displacement of the pistons in the cylinder, and as there is practically no clearance in the pump chambers, the pressure in the cylinder at the end of the suction stroke will be about twice the atmospheric pressure; that is to say, the charge admitted is double what it would be in an engine of the ordinary four-cycle type, with the same cylinder dimensions.

The end of the piston rod forms a slide, working in a slot in one arm of a double-armed lever, the other arm of which is joined to the crank by means of a connection rod. The double-armed lever rocks on a shaft, which is supported by a bracket on the cylinder. Owing to the balanced motion of the pistons, and a large flywheel, the engine operates very smoothly, but one would be led to believe, from theoretical considerations, that the charge being double, the cylinder pressure at the moment the exhaust valve opens would be about double what it is ordinarily, and that, as a result, the difficulties of muffling the exhaust would be greatly augmented. The engine at the Champ de Mars, the only one which the writer has seen in operation, having the exhaust gases led away by pipes, it was impossible to tell to what extent this difficulty does exist.

Arnot & Marot, of Paris, exhibit a rotary engine, which can be run by steam, compressed air, gas, gasoline, etc. The engine has four cylinders, and when working with steam or compressed air there are claimed to be 8 impulses per revolution, while with gasoline there are 4 impulses. The two engines shown are both constructed as explosive engines, having flanges on the cylinders for air cooling and ignition plugs of the jump-spark variety. The engines have no flywheel, and are claimed to be entirely vibrationless. The writer hopes to be able to give a detailed description of this engine later on.

Besides the Waché & Kriéger extensible pulleys, recently described in THE HORSELESS AGE, there is exhibited another system of extensible pulleys by M. R. De Montais, of Beauvoir (Eure et Loire). The hubs of the pulleys are in two parts, and by approaching or withdrawing these two parts from each other, the diameter of the wheels is increased and decreased respectively. The two hub parts of one of the pulleys are regulated by turning a shaft with a right and left thread, the same as used with the Reeves speed-changing device made in America. The diameter of the other pulley is varied automatically by the tension of the belt, and by springs. The springs on the shaft tend to increase the diameter of the pulley, which latter is limited by the length of the belt. Rather extravagant claims are made for the transmitting capacity of this device, but, perhaps, the rating is in line with that used for gasoline engines in France, in which case there is no ground for criticism.

The tire question also has received its share of attention, there being two forms of iron-armored rubber tires on exhibition. One of these is a pneumatic, and is called by its manufacturer "Hélène." It is a double tube tire to the outer tube e, of which is cemented a sort of shield c r. This shield has a flat substance on its outside, to which is fastened a belt c o. To this belt are riveted the metal sections, which form the main protection of the tire. This construction does away entirely with punctures, and it is claimed that the tires will not make any more noise than the regular pneumatic. Armored single-tube tires are also shown by the same firm, while another firm shows solid rubber tires with metallic segment protection.

A large number of the exhibits of detail parts relate to ignition devices for gasoline engines. The exhibits contain spark plugs for jump-spark igniters, interrupters, spark coils and induction coils, storage batteries and primary batteries, the latter mostly intended for recharging storage batteries.

A number of machine works exhibit steering and driving axles for automobiles, hubs, springs, etc. The old-fashioned C spring is coming again into favor, and is used especially with light voiturettes. For heavier vehicles semi-elliptic springs are generally used.

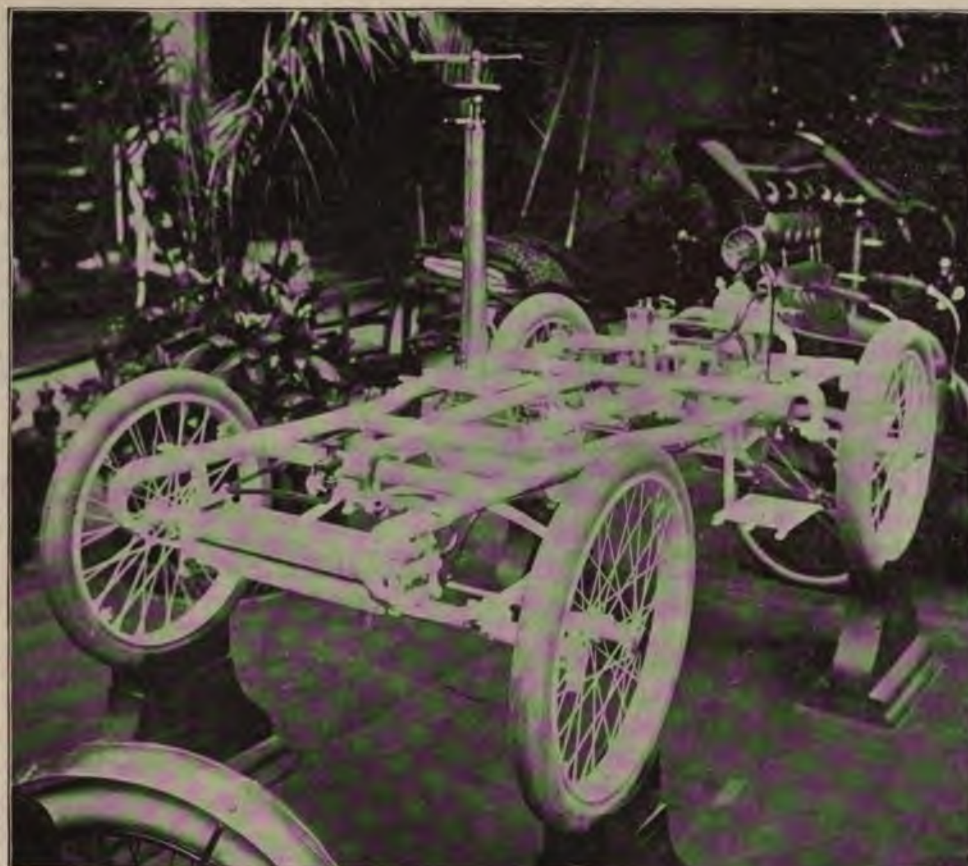
Another detail, which is well represented, is the chain. Chains were very generally used on gasoline automobiles in France, and often even on electric vehicles. They have, however, been the source of considerable trouble, and many of the lighter vehicles are now made chainless. A form of chain which, to the writer's knowledge, is not used in America, but quite extensively employed in Europe, especially on heavier vehicles, is the toothed chain. This form of chain appears to work very satisfactorily.

Acetylene lamps for automobiles are shown in great variety, and of very tasteful design. Some of these lamps, used especially for high-speed vehicles, are very large, and give a very intense light. French *chauffeurs* favor a liberal use of lamps, the writer having seen vehicles which were equipped with as many as four lamps—one in front of the dash, one on each side of the seat, and one in the rear of the vehicle.

Multiple oilers for automobiles are exhibited by a number of firms, and their use in connection with heavier vehicles is very common in France. They usually supply all the bearings requiring constant oiling, and are located in some conspicuous and easily accessible place—on the back of the seat, on the inside of the dashboard, or on one of the side panels of the seat.

The firm of E. Teste Fils makes an exhibit of signal trumpets, with rubber bulbs, which are very much used on automobiles in Europe. When the writer first had occasion to notice these trumpets, while in Berlin last winter, he was favorably impressed with them, as they are here used for automobiles only, and are, therefore, helpful if one wants to form an opinion of the extent of the circulation of automobiles in any given place. But in Paris this impression has entirely changed. In the first place, automobiles circulate here in such numbers that one cannot help but seeing them, even without one's attention being called to them by the trumpet; and, besides, the use of the trumpet is not confined to automobiles—all the street cars and omnibuses, and a great many bicycles, carry them also. The continual sound of the trumpets, which are usually much larger and louder than they need to be, especially on bicycles, is anything but agreeable, and it is the writer's opinion that the bell commonly used in America is a much preferable signaling apparatus.

All the larger automobile manufacturers of France exhibit quite extensively. Our illustration, Fig. 3, shows a view from the stand of De Dion & Bouton, and especially the "chassis" of the light De Dion vehicle exhibited here. There are also shown, at this stand, two of the light vehicles finished, two motor tricycles and two motor quadricycles; also examples of the three forms of gasoline engines built by the firm; air cooled, water cooled, and air-cooled cylinder and water-cooled head engines. Of the first type it is stated that 15,000 have been sold, while the number of sales of the last type amounts to 2,300.



RUNNING GEAR OF THE DE DION LIGHT CARRIAGE.

Of the large steam vehicles of De Dion & Bouton, none were shown at the Fair; but two of these vehicles, a closed omnibus and a large char-a-bancs, destined for service in Spain, were shown in operation in the vicinity of the Exposition for some time. A "Train Scotte" also furnished communication between the Exposition grounds and various parts of the city, the fare charged being 10 cents. It seemed to have but little patronage, however. In the Exposition grounds at Vincennes the writer noticed a similar service, the "train" consisting of a tractor and a trailer, built by Le Blanc. The tractor of this train made a deafening noise, and was in every respect more suggestive of a traction engine than of an automobile as it is usually conceived.

Panhard & Levassor also have a very creditable exhibit, and so have Peugeot Freres and Georges Richard. Each of these firms has about half a dozen vehicles of different types on show.

In comparing the exhibits of the various nations, contributing to the automobile exposition, France, of course, makes the best showing, there being more than 200 vehicles of French manufacture on view in the various sections in which automobiles are exhibited. It may be of interest to the readers of THE HORSELESS AGE to know that the United States comes right after France in point of number of vehicles exhibited. On the 20th of July there were 35 vehicles on exhibition, of which 28 are electrics and 7 steam vehicles. Some of the stands in the American section at Vincennes were still empty, while others were to receive additional vehicles.

In the German sections there were at this same date 23 regular vehicles (mostly gasoline), one tricycle, two bicycles, and one historical machine. Belgium shows six vehicles, and Austria, Switzerland, Italy and England each one. The Italian vehicle, the voiturette of Prinetti & Stucchi, already described, stands in the Italian section of the Cycle Building at Vincennes, and the English vehicle, a three-wheeled electric cart, in the gallery of the Electricity Building, so that the spaces allowed to England and Italy in the Automobile Building at Vincennes do not as yet contain any automobiles.

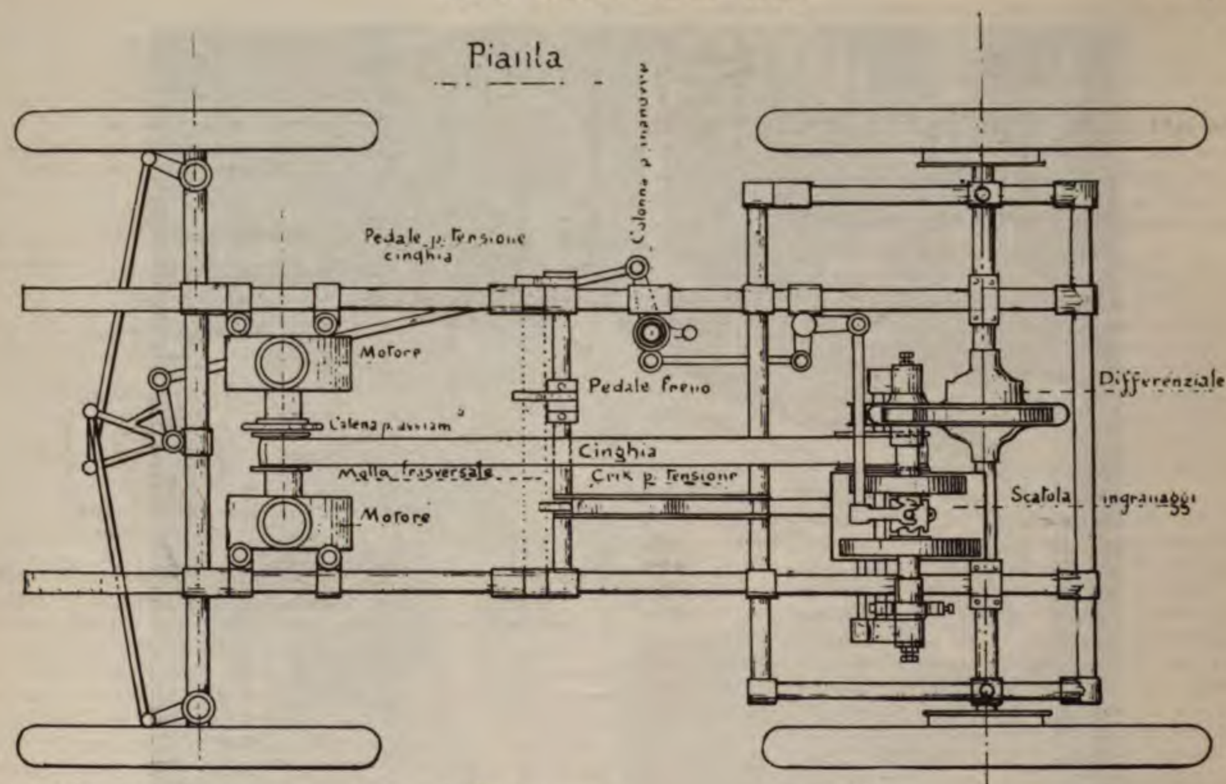
The exhibitors of automobiles in the U. S. section are: "The Columbia Electric Vehicle Co.," "The Riker Electric Vehicle Co.," "The Cleveland Machine Screw Co.," "The American Electric Vehicle Co.," "The Locomobile Co. of America," and "The Stanley Manufacturing Co."

The Columbia Electric Vehicle Co. has seven electromobiles on show at the Champ de Mars, and five at Vincennes. At the latter place it also shows one of its light gasoline delivery vehicles. Among the vehicles shown at the Champ de Mars are an omnibus, an ambulance and a delivery vehicle. The Cleveland Machine Screw Co. exhibits five of its Sperry vehicles, which draw attention on account of their controlling arrangement. Starting, changing of the speed and steering are effected by different motions of the same lever. These vehicles are of a very high finish, while the trimming is also of a high grade.

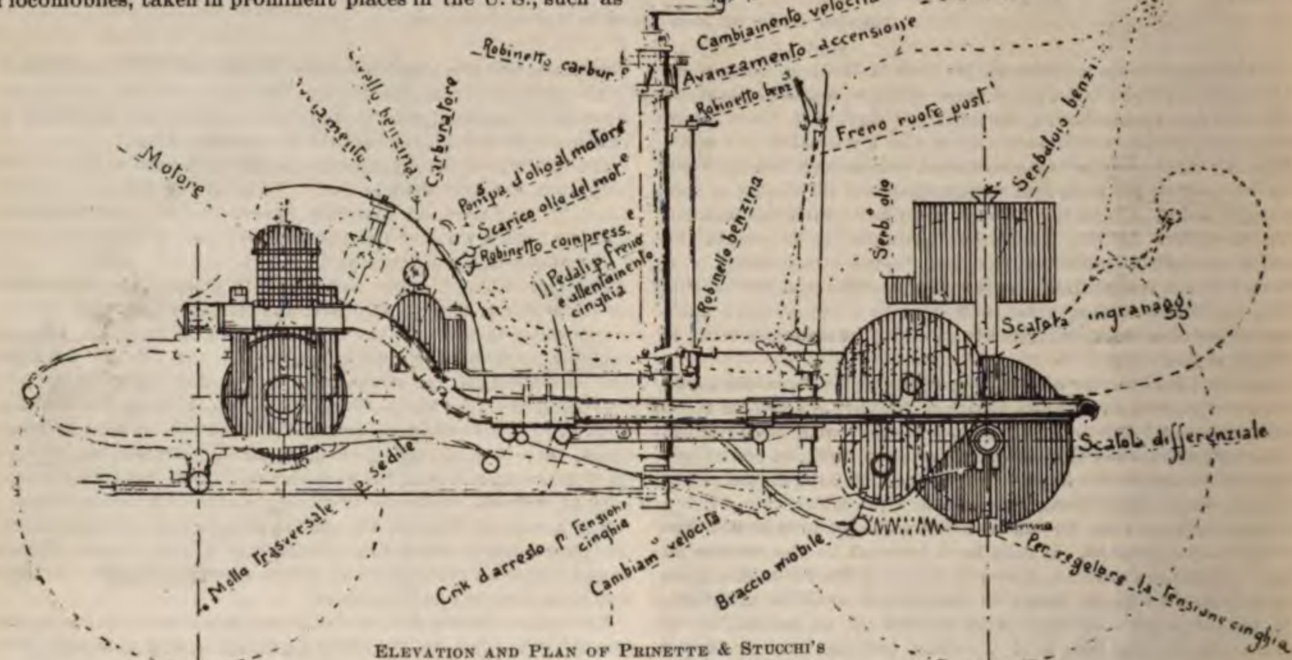
The American Electric Vehicle Co. shows two of its vehicles, one phaeton and one break. Originally both of these vehicles were located at the Champ de Mars, but recently one of them has been removed to Vincennes.

The Riker Electric Vehicle Co. is represented in France by the Societé Française des Vehicules Électriques, and this firm is in charge of the Riker exhibit at the Exposition. The exhibit at the Champ de Mars consists of one running gear with motor, one victoria with American carriage work, one victoria with French carriage work, one coupé, one brougham, and one delivery wagon. The Societé Française ordinarily receives from the United States only the running gears, and the carriage work is done in France.

The Locomobile Co. of America shows at the Champ de Mars




three vehicles, and at Vincennes two. It also exhibits a separate boiler and an engine, giving visitors an opportunity to inspect, and get acquainted with, the details of their machines. A number of swinging easels contain drawings and photographs of locomobiles, taken in prominent places in the U. S., such as




ELEVATION AND PLAN OF PRINETTE & STUCCHI'S GASOLINE CARRIAGE.

in front of the capitol in Washington, D. C., on Mount Washington, etc.

The Stanley Manufacturing Co. exhibits two of its steam vehicles at Vincennes. These vehicles possess to a high degree the elegance of construction which is characteristic of American automobiles. The two vehicles arrived only recently.

The American Roller Bearing Co. shows two wheels with roller-bearing hubs. One of these wheels is provided with a 36"x5" pneumatic traction tire, and the other one with a heavy iron tire, the weight of the latter wheel being 650 lbs.

The Veeder Manufacturing Co. also has a stand in the American automobile section at the Champ de Mars, where it exhibits counters and cyclometers for cycles and automobiles.

# ...OUR... FOREIGN EXCHANGES

## THE RAOUVAL VOITURE.

In THE HORSELESS AGE of May 23 was published a small photograph of the Raouval voiture, built by the Société de Mécanique Industrielle d'Anzin, of Anzin Nord. We are indebted to the *Motor-Car Journal* for the following particulars regarding these vehicles. The motive power is supplied by a two-cylinder vertical motor of the "Pygmée" type; it is capable of developing from six to eight h. p., the speed ranging from 650 to 800 revolutions per minute, the cylinders being 110 mm. in diameter, by 150 mm. stroke.

The motor is located at $M$ (Fig. 1), in the front part of the frame, with its shaft arranged longitudinally. The motor shaft $O$ carries the fly-wheel $U$, which forms the female portion of the clutch, the male portion $U^1$ being loose on the shaft. The disc $U^1$ is connected by means of the coupling sleeve $F$ with the variable speed gear shaft. Three forward speeds and a reverse motion are provided. The speed-changing gear is enclosed in the case $K$, and comprises three spur-wheels, gearing with corresponding pinions on a short intermediary shaft below and parallel to $O$. The reverse motion is obtained by means of a lever acting on the bevel wheels $L^1$ $L^1$ on the differ-

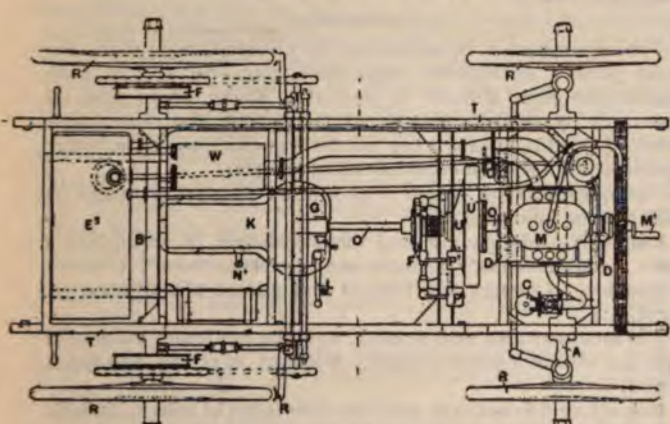


FIG. 1 PLAN OF RAOUVAL CARRIAGE.

ential countershaft $G$, the direction of running of the car depending on which of these wheels is in gear with the bevel pinion $L$ (Fig. 2). From this intermediary shaft, $G$, the power is conveyed through duplicate sets of sprockets and chains to the rear axle. To prevent any reverse motion to that desired, a sort of free-wheel arrangement is introduced on the end ($P$, Fig. 2) of the variable-gear shaft $I$—a section of the clutch being given at the bottom of Fig. 2.

The control levers are located close to the steering standard $N$, controlling the variable speed gear and $L$ the reverse motion. The mixture is controlled by a handle, $H$, in the center of the steering wheel, connected with the valve of the carbureter by a steel cable. Steering is controlled by an inclined wheel; it is of the "progressive" type. The movement of the handle wheel $m$ (Fig. 3) is transmitted by an eccentric pinion $k$, and a sector $h$—resulting in a progressive angular displacement—to a second shaft $g$, at the extremity of which is a lever $f$, the end of which is connected by an arm $e$ to the rod $b$, which actuates the arms $c$ and $d$. By means of this arrangement a full "lock" is, it is stated, obtained by the movement of the hand-wheel through a third only of a revolution.

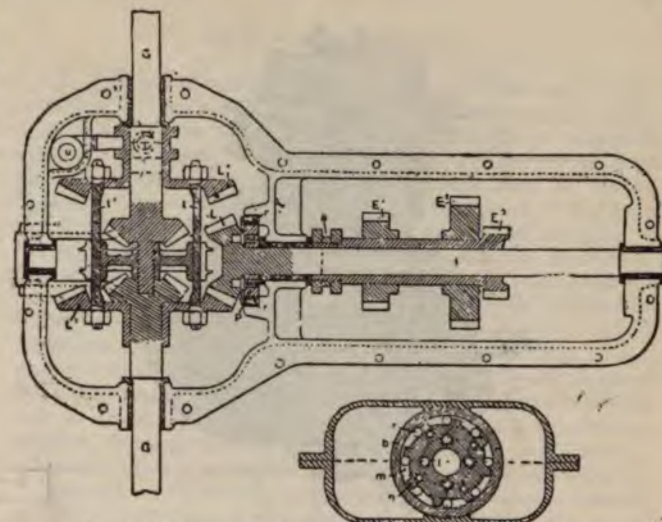


FIG. 2. SECTIONAL VIEW OF VARIABLE SPEED GEAR.

The frame $T$ (Fig. 1) of the car is built of U-section, connected by five stays of similar material; it is supported on the axles by means of plate springs, the body being entirely separate from the frame. Any type of two or four-seated carriage, or a delivery van, may be fitted thereto. The road wheels are of wood, 40 inches diameter rear, and 31½ inches front, and are shod with pneumatic tires. The water tank is located at the rear, while a cooling coil is carried in front, the circulation being maintained by a small pump. The petrol tank is arranged under the seat of the body. Three brakes are provided: one acting on the hubs of the rear wheels, one on the differential shaft, and shoe brakes on the rear wheel tires. The foot pedal controlling the hub brakes is also so connected that, on its being pressed down, the friction clutch $U$ is also put out of engagement; a similar arrangement is provided not only in connection with the pedal which actuates the brake on the differential, but also in regard to the hand lever controlling the tire brakes.

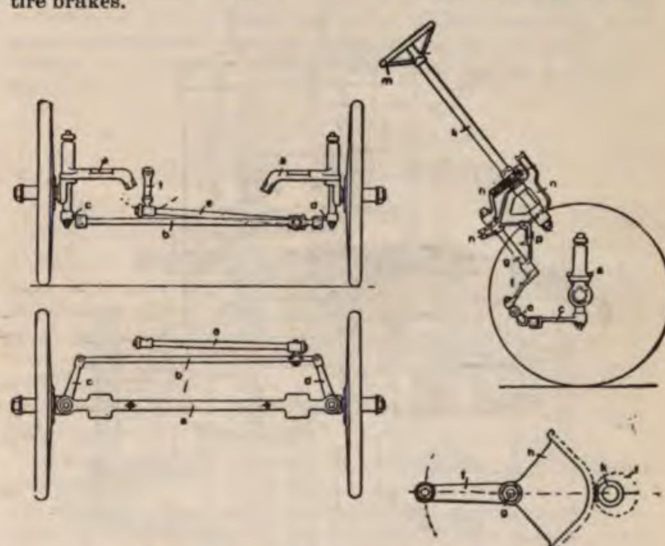


FIG. 3. DIAGRAMS OF PROGRESSIVE STEERING DEVICE.

A general view of the motor is given in Fig. 4, while a sectional view is reproduced in Fig. 5. The admission valves are located in the cylinder ends, $C$ $C^1$ while passages $b$ $b^1$ are formed on the right-hand side, communicating with the vaporizing chamber. On the left-hand side are passages $u$ communicating with the exhaust valve $E$ $E^1$. Above the crank-shaft

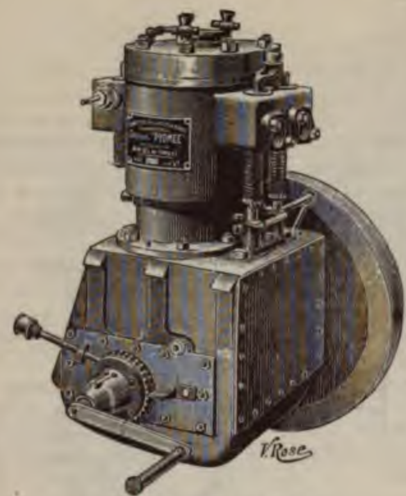


FIG. 4. RAOUVAL MOTOR.

and driven off it by the spur wheels $g\ g^1\ g^2$ is the cam-shaft $F$, which at one end is provided with a centrifugal governor $H$. In the middle of the shaft are two cams, $f\ f^1$, in continuous contact with which are rollers fixed on the lower ends of the slide $e\ e^1$. These slides, which pass through a plate $G$, serving as a guide, have a slot formed on the face and extending their whole length, small screws passing through the plate $G$, and projecting into this slot, preventing the rods from turning. Just above the plate $G$, the slides $e\ e^1$ meet and push up and down the exhaust valve spindles $d\ d^1$. In continual contact with the sleeve of the governor is a pivoted arm $h$, which at its upper end is rigidly connected to a bar $t$, extending across the front of the cylinders, and guided by the plate $G$. On the top of the latter are pivoted two pawls made to work in unison by means of the spring $R$. Should the speed of the motor become excessive, the governor allows the arm, and consequently the bar $t$, to move towards the left. This movement brings a stop on the bar $t$ in contact with the pawl $I$, the end of which is forced into a hole in the end of the slide as soon as the latter reaches the pawl, thus preventing the exhaust valve $E$ from being opened. The two slides $e\ e^1$ do not touch the pawls at the same time, but alternately, so that only one exhaust valve is closed at a time. As soon, however, as the slide $e^1$ rises to the pawl $I^1$, the latter slips under the action of the spring $r$ into its hole, thus preventing the exhaust valve $E^1$ from opening. When the speed of the motor once more reaches the normal, the governor permits the spring $R$ to draw back to the right the bar $t$; in doing this the stop $k^1$ pushes the pawl $I^1$ out of the hole in the end of the slide $e^1$, the pawl $i$ at the same time releasing the rod $e$. Tube or electric ignition is employed as desired; the carbureter adopted is of the well-known Longuemare type, while the cylinders are, of course, water-jacketed. The crank and crank-shaft work in a dust-proof oil-containing casing $A$, the ends of which form a bearing—of bronze metal—for the motor shaft. The casing is provided with detachable covers, to render the piston rods and cranks readily accessible.

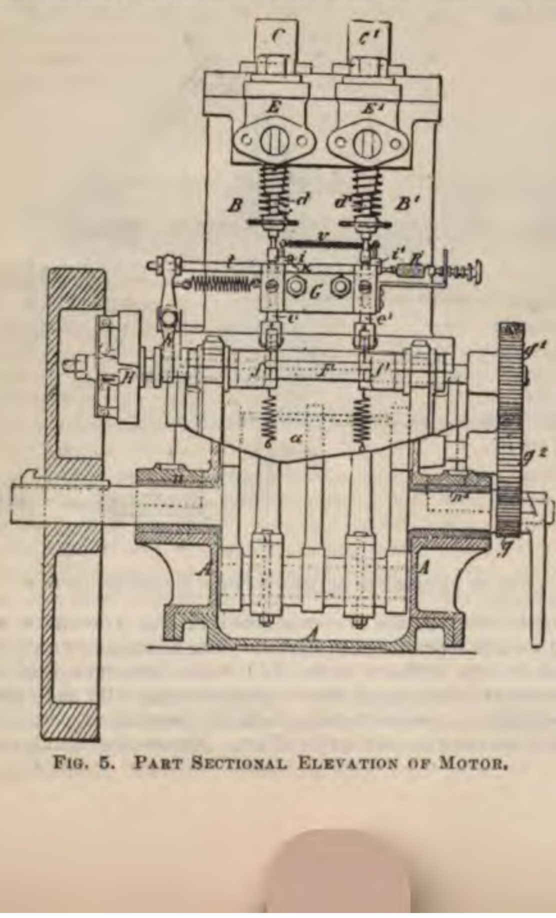


FIG. 5. PART SECTIONAL ELEVATION OF MOTOR.

## THE INTERNATIONAL AUTOMOBILE CONGRESS.

REPORT ON ELECTRIC VEHICLES.

We give herewith a translation of the report made by M. Hospitalier, secretary of the second section of the Congress, which occupied itself with the question of electric vehicles.

The object of the report was to point out in a summary, but precise, manner the points, a discussion of which would be profitable to all.

ACCUMULATORS.

The accumulator is, according to unanimous opinion, the least perfect automobile apparatus, and—we say it with regret—the most difficult to improve. Forty years after its discovery by Gaston Planté, 20 years after the remarkable work of Camille Fauré, it has not been possible to find a better material than lead to store electrical energy.

The questions on which a profitable discussion might be held are the following:

Respective advantages and inconveniences of accumlators with "autogeneous" (Planté) and "heterogeneous" (Fauré) formation. (Electrically formed and pasted plate batteries. E. H. A.)

The most suitable acid density, and the minimum volume of acid to obtain a good capacity without carrying too much liquid.

Respective advantages and disadvantages of heavy, durable batteries and light batteries with rapid deterioration.

Forms of construction and assembling, to facilitate the replacement of deteriorated plates and the repasting of the same.

Jars, coverings and connections.

Best rate of charge. Rapid charge. Charging at constant potential. Respective advantages and disadvantages of charging accumulators in and out of the vehicles.

Usefulness of devices limiting the excessive currents to which the batteries are subjected during the period of starting the vehicle. Grouping of the batteries, special arrangements of the controller or an automatic apparatus limiting the current.

Numerical data on the conditions of operation of actual accumulators. Specific rates of charge and discharge. Efficiency.

Quantity of energy furnished by a positive or negative plate, of a given weight, before replacement or refilling.

Assembling of the batteries in the trays. Best place for accumulators. Means of readily withdrawing the batteries from the vehicle for cleaning, charging or replacing.

ELECTRIC MOTORS.

The electric motor is an incomparably more perfect apparatus than the storage battery. It seems difficult to make any great improvements on it, either as regards efficiency or specific

power, since a motor of 2 kilowatts may attain, at full load, an efficency which sometimes exceeds 85 per cent., at a maximum weight of 130 to 175 pounds. The electric motor also has a great flexibility, as it may furnish, in case of starting, for example, a torque twice or three times as large as its normal torque.

In order to reduce transmission parts, to save their weight and the losses occasioned by them, the angular speed of the motor must be reduced sufficiently to engage the wheels directly and may even be attached to the hubs of the wheels, with a motor for each wheel, doing away with with the gearing and the differential.

The method of exciting the motors, series, shunt, or compound, might be made the object of an interesting discussion, as well as the question of recuperation applied to braking.

The use of a motor with double armature, or of a single armature with double winding and double commutator, or of two separate motors, present advantages and disadvantages, which it would be well to discuss, in order to define the cases in which any one of these arrangements should be used. It would also be interesting to discuss the advantages of the driving wheels being placed in front or in the rear, the employment of chain or gear transmissions, and the method of suspending the motor or motors.

CONTROLLERS.

The controller is, in one sense, the brain of the electric vehicle, and its arrangement is, therefore, of the same importance as that of the storage battery and the motor.

Its construction does not present, in itself, any difficulty, as the currents, which flow through it are, in general, not of a very high intensity, but opinions still differ in regard to the functions which the controller should perform.

It would be advisable to fix definitely the ideas concerning the respective advantages and disadvantages of the variable connections of accumulators, electric braking, recuperation, special arrangements for reversing, automatic interlocking devices, to prevent false maneuvers, and, above all, the production of excessive currents, so injurious to the life of accumulators, whatever be the system.

ACCESSORY APPARATUS.

We denote by this title measuring, controlling, and security apparatus.

We believe, voluntarily, that measuring instruments on vehicles destined for public service, and in incompetent hands, are useless, and even dangerous.

The duties of an electric vehicle conductor should be reduced to a simple operation, to be performed without understanding.

It is not the same case, we think, with vehicles *de luxe* and pleasure vehicles, operated by the proprietor, who is interested to know the conditions of his vehicle at each instant.

An energy meter (watt hour meter), or otherwise, a quantity meter (ampere hour meter) are also very useful, to tell at any instant the state of discharge of the battery.

Manufacturers of measuring instruments will take a place in the electric vehicle trade when they have produced instruments adequate for this delicate service.

It is equally necessary to make use of security apparatus, and particularly of a simple instrument indicating when the battery is discharged 80 to 85 per cent. of its capacity, in order that the driver may renew in time and not run out of current, and without abusing the accumulators, for which an over-discharge is absolutely disastrous.

The Automobile Congress can also resolve the question now pending, regarding charging stations and universal current plugs. The competition which was instituted, 18 months ago, by the Automobile Club of France, and other interested societies, not having given satisfactory results, the question may be taken up again with some chance of success, as the need of unification is felt more as the number of charging stations increases.

## "CLUB POWER."

J. S. Walton, in a paper upon the "Comparison and Determination of the Power of Motors by the Volume of the Cylinder," presented to the recent National Congress of Automobilism at Perigueux, after a brief discussion of the advantages and disadvantages of the various methods used up to the present for measuring the power of motors, says: "The indicated horse power would be a perfect method of gauging if the velocities employed with our motors did not vary from 450 to 2,500 revolutions per minute—a fact that has rendered our indicators inapplicable, especially for extreme velocities." Under such circumstances, in order to reach a rapid and practical unification, he proposes the establishment of a unit of power, which he would call "club power," and which is based upon the displacement, in volume, of the piston multiplied by half of the revolutions of the maximum rate of running per minute. He uses the expression "maximum rate of running" advisedly, since accelerators are made to be used at a pinch.

Upon taking 8-1,000ths of this product, we obtain, through a simple calculation, a very fair approximation of the unit of power upon the crank shaft.

As an example, let us take a two-cylinder motor having a capacity of two litres and 1,000 revolutions, and we shall have:

$$\frac{2.00 \times 1,000}{2} \times 0.008 = 8 \text{ horses in club-power.}$$

To the possible objection that the number of revolutions per minute will be difficult to determine, the author responds that this is doubtless so, but that every one can verify this detail of running much more easily than he can perform a brake experiment; and the criticism that might be urged that the compression chambers are not comprised in the measurement proposed by the club power, Mr. Walton answers by saying that upon taking the displacement of the pistons and the number of revolutions, we have an equal gauge for all cases. The duty of determining the compression, which in our motors varies from .4 of a kilogramme to 3 kilogrammes per square centimetre, must be left to the manufacturer.

Concisely stated, then, the unit of power (club-power) for automobiles will be determined by taking the number of litre-minutes displaced by the pistons, multiplied by half of the revolutions of maximum running, multiplied by the co-efficient 0.008.

## AUTOMOBILE ACCIDENTS.

A number of rather unusual accidents are reported in "Die Automobilen Industrie."

The Duke Massena de Rivoli, while at Kreuznach, Germany, made a pleasure trip with his family in an automobile, in the Guldenbach Valley, when suddenly the steering rod of his vehicle broke, and the vehicle, now beyond the control of the driver, went at full speed into the Guldenbach (brook). The passengers were projected from the vehicle, but the injuries they received were slight. They had to walk to Stromberg, where they engaged a vehicle to take them back to Kreuznach.

A German military automobile, making a test trip in Alsace Lorraine, met with an accident between Puzieux and Delme. The steering gear having become inoperative, the vehicle collided with a tree while going at a rate of about 30 km. (19 miles) an hour. The three passengers, a lieutenant, a sergeant and a machinist from the Cannstadt-Daimler factory, were projected with great force from the vehicle. This was their good luck, for the vehicle at once caught fire, and in a few seconds was entirely enveloped in flame. The vehicle carried an extra gasoline tank, of about 16 gallon capacity, and there was, therefore, a large amount of fuel for the flames.

All the passengers escaped without very serious injury, but the vehicle and contents were entirely destroyed by the fire.

## PHONOGRAPHS INSTEAD OF SALESMEN.

An interesting innovation in connection with exhibitions will be introduced at the permanent automobile exhibition which opens in Berlin this month. It would, of course, be rather expensive for the exhibiting firms to have a representative constantly in attendance, so the director of the exhibition, Engineer Freund, has conceived the idea of using the phonograph to expound the merits of the various machines, etc. The management has procured several phonographs, and a cylinder for each exhibitor. A description, containing the most important points, accompanies each exhibited article, and these descriptions are recorded on the cylinders. If a visitor desires any information concerning a certain article, the attendant of that section places the corresponding cylinder in the phonograph, and puts the latter at the service of the visitor The instrument is entirely at the visitor's command, and may be stopped and restarted as often as convenient.

## THE GOOD SAMARITAN DISCOURAGED IN PARIS.

"One never knows where the silliness of the French administration stops," says *La Locomotion Automobile*.

The other day Girardot met, on some corner of Paris, a friend of his, a *chauffeur*, whose machine was broken down. He found a piece of rope, took the invalid in tow, and brought it to its destination. But a policeman appeared on the scene and placed him under arrest, because two vehicles form a train, and the circulation of automobile trains is forbidden in Paris.

## DEATH OF ETIENNE LENOIR.

Etienne Lenoir, who figured conspicuously in connection with the early history of the gas engine, recently died at Varenne—Chennevières, near Paris, at the age of 78 years. Besides inventing the gas engine bearing his name, he applied it to a motor vehicle, but without any marked success. The Automobile Club of France recently voted him a bronze medal, in recognition of his work in the gas engine and automobile lines, but the medal had not yet been delivered at the time of his death.

There was shown to us the other day, says *La Locomotion Automobile*, a modification of the type of carriage in which a gasoline motor actuates a dynamo that charges accumulators, which run an electric motor. The innovation consists in the fact that the carriage is provided in front with a seat designed for the driver and another person, and that the former has nothing to do but attend to his steering wheel, disengaging gear and brakes. The engineer, seated behind, has in front of him, and in plain sight, the gasoline motor dynamo and carbureter. All of these are within reach of his hand. In case of damage to the motor, he can, by stopping the latter, allow the carriage to continue its route like an ordinary electric vehicle, and quickly make his repairs without leaving his seat.

A correspondent in *The Motor-Car Journal*, replying to an earlier correspondence, states that the use of leather belting on the inside of pneumatic tires is an old idea, and has been tried probably by hundreds. The difficulty with it is that the leather belt cannot be made part and parcel of the outer tire, and that a great deal of chafing is set up. The simplest way to avoid punctures is to have large diameter tires, so as to make the weight per square inch of surface small, and it will require a relatively sharp instrument to cut through the outer tires. With large diameter tires, punctures are extremely rare.

Apropos of the popularization of the automobile in England, *The Motor-Car Journal* says:

"During the recent hot weather, when horses had to take to sun-bonnets, and many fell to the pavement faint or dead, the idea of the adoption of motor-vehicles for city traffic received a great impetus. No less so did the heavy rains of the past few days influence public opinion, for the way in which horses slipped and fell was most distressing. Possibly these facts have something to do with the more general appearance of motor-vehicles in the streets. One can hardly ever go out without seeing a motor-vehicle, and such London thoroughfares as Holborn, Shaftesbury avenue, etc., are veritable automobile promenades. These are signs that show the future popularity of motor as compared with horse traction."

# ...COMMUNICATIONS...

## A LONG RUN ON ONE CHARGE.

37 WALBROOK, LONDON, E. C. August 8.

*Editor* HORSELESS AGE:

It will interest your readers to know that a voiturette to carry two persons, constructed under the patents owned by this syndicate, made a most successful trial trip from London to Brighton recently, using one charge of electricity only, the total run being 53 miles by cyclometer, or one mile over the exact distance between the two towns.

We started from Wilson street, Finsbury Square, at 11:30 a. m., passed through the congested traffic over London Bridge by the Borough, Kennington, Brixton, Streatham, Croydon, Merstham, Redhill, Horley, Crawley, Handcross, Hickstead and Patcham to Brighton. The following are briefly the particulars of power, etc.:

This voiturette is equipped with two 2 h. p. Joel electric motors, running at a speed of 600 revolutions per minute with 30 volts, these two motors are fixed on a detachable spring frame, and drive the two back wheels of the carriage separately by one inch chain gear of nine to one. The current is supplied by 32 Rosenthal storage batteries, made up in two sets of 16 cells, joined in parallel, giving 32 volts, and 20 to 40 amperes, with an output of 140 ampere-hours.

The total weight of the carriage is under 12 cwt., of this 7½ cwt. is battery, motors 2 cwt., and the carriage itself only 2½ cwt. The wheels have pneumatic tires, the back wheels are 2 feet 9 inches, diameter and the front wheels 2 feet 6 inches diameter. The front track is 3 feet, and back track 4 feet 6 inches, and the base is 4 feet 6 inches. The controller is very simple in construction and action. The system of electrical changes is such that when the voiturette is ascending hills the motors work at their highest efficiency and at normal speed, they are geared down to run the car uphill at 6 miles an hour, while on the level, the car is run from 8 to 12 miles, or faster if desired. There are also two slow speeds forward of 3 and 4½ miles, and a slow speed backward of 3 miles per hour. When going down hill the motors act as a brake, and on steep hills give a back charge to the batteries.

A careful series of tests were made on this journey, and the current used was measured. On level roads, such as from the Elephant to Croydon, the current varied from 10 to 20 amperes per cell; on inclines of 1 in 40, such as experienced between Croydon and Merstham, the current rose to 40 amperes per cell, the average current used being about 20 amperes per cell. On the steepest part of Redhill the current touched 45 amperes per cell, this, with a pressure of 32 volts, giving an effective of

4-h. p. to the carriage. On the other hand, when going down Merstham hill, Earlswood Common, Handcross hill, etc., we were recharging about 15 amperes per cell, or practically returning about one-fourth of the current, the returned current making an appreciable difference in the run. (Of course, on level roads the distance travelled would have been very much greater.)

The run was made at an average speed of 10 miles per hour, or in 5¼ hours actual travelling, and varied from 15 miles per hour on the level or slight inclines to 6 miles per hour going up the hills.

The carriage was made by Mulliner, of Northampton, and the electrical and mechanical part by Joel & Potter, of London. The roads were in good condition, but a very strong head wind prevailed throughout.

Yours faithfully, V. C. Doubleday, secretary.
The National Motor-Carriage Syndicate Limited.

## THE TRUE STORY OF MAJOR DAVIDSON'S MISHAP.

Highland Park, Ill., August 24, 1900.

*Editor* Horseless Age:

Some weeks ago I started from Fort Sheridan with a motor gun wagon to carry a message to Gen. Miles at Washington. With the exception of two or three minor troubles, such as the loosening of nuts and the short-circuiting of batteries, we got along nicely to just this side of Hammond, Ind., when one of our rear tires exploded. I was using some inferior tires, but as I had ridden some thousands of miles through Central Illinois with them, I assumed they would carry me at least 100 miles further to La Porte, Ind., where I had contracted with the Preston Hose & Tire Co., of Everett, Mass., to have new tires for me. On sending a messenger ahead, I found, however, that they had failed to arrive. To make a long story short, I was compelled to wait there, camped in the sand hills for 22 days before we could get our tires, all manner of accidents having happened at the tire factory in the meantime.

When we at last did receive them, having in the meantime ridden the carriage some twenty miles on a flat tire to get into a better country, it began to rain. We pushed on, however, to La Porte, Ind., much of the way through heavy black mud, and as it continued to rain for seven days straight, I was compelled to postpone the trip on account of work at home.

I wish, to say, however, that the engine did not explode, nor did we have any serious trouble aside from our tires. I am, in fact, so confident the trip can be made that I am now planning to build another carriage and take a battery of two carriages with this message to Washington. This I hope to be able to do some time in October.

Generals Wheeler and Miles have both given their consent to retain the message, as we have never failed in carrying out what we started to do in the past, we do not intend to on this.

In the meantime, I would appreciate a correction of the widespread report that our engine blew up. The Associated Press reporter at La Porte saw us give an exhibition of this carriage while at La Porte before loading on the train, and saw us ride the carriage up the incline to the platform, dodge in and out among the freight, and stop the carriage inside the freight house.

Yours very respectfully, R. P. Davidson.



## PROPORTION OF BORE AND STROKE IN TWO CYCLE ENGINES.

*Editor* Horseless Age:

Is there any objection to making a two-cycle engine of a longer proportionate stroke than seems customary? Would not 3½-inch bore by 5-inch stroke be better? Would it not utilize more of the explosive, and by expanding the charge further than in a shorter stroke give a quieter exhaust?

What horse power is above size? Beta.

[There is no valid reason why an engine with the cylinder dimensions mentioned by our correspondent should not give good results, but it would not have the advantage over engines in which the dimensions of bore and stroke are more nearly alike, that he expects of it. The pressure in the cylinder, at the moment the exhaust opens, is independent of the relative dimensions of bore and stroke, as a simple example will show.

Supposing a 4 by 4 cylinder engine of the two-cycle type: This engine, during the intake stroke, will draw in a certain charge, which will be exploded, and fill up the cylinder space at the end of the power stroke. If we now take a 4-inch by 8-inch cylinder engine, our cylinder has just twice the capacity. It will receive, therefore, a charge just double that of the first engine. This charge is ignited and expands the same as in the first engine, and at the end of the stroke it occupies the whole space of the cylinder, which, as stated, is double that of the first cylinder.

The charges have, therefore, the same quantitative relation to the cylinder volumes in each case, and consequently the pressures must be equal. In practice, there might be a slight difference in pressure, however, as the greater the difference between stroke and bore, the greater is the radiating surface of the cylinder walls for an engine of given volume. The gases have, therefore, a greater chance to cool in a cylinder with long stroke and this would somewhat affect the exhaust pressure, but it certainly does not augment the relative utilization of the charge.

An engine of the dimensions cited should develop between 1½ and 2 h. p.—Ed.]

## MORE STEAM EXPERIENCE.

Chicago, Ill., Aug. 19

*Editor* Horseless Age:

As many of your readers are telling their experiences in the columns of your paper, and as I have read them with much interest, I thought perhaps somebody would like to hear my views. I have been running a steam carriage since last June, and have drawn some conclusions myself. The carriage itself is a good machine, and in all this time I have not spent a cent for repairs or had to do any myself. Of course, I have had little experiences like dirt in the check valves, and once I found a piece of solder in the feed-pump, but as all users of steam carriages look for such things to happen now and then it is to be expected.

I had trouble with the flame blowing back, and I put a small gauze over the chimney (about 100 mesh, brass), and had no further trouble. This only happened when riding with a stiff wind.

I believe that for ease of manipulation and riding qualities the steam carriage is without a superior.

Much trouble would be saved however if means to heat the torch were provided on the carriage. This is not difficult at all, as I met a friend recently who has a device as follows. It is simply the top from a painter's torch or brazier, with the pan and a needle valve. This is connected by a joint of pipe to where the torch is connected, the whole apparatus being entirely inside the burner, and burning with the burner all the time. When the carriage is to be used, the needle valve is turned, letting a little gasoline

into the pan, which is lighted and heats the perforated tube, generating gas, which starts the device and, in turn, heats the joint of pipe, thus getting gas for the main burner. It also acts as a pilot light, as it takes gasoline from the place where the torch usually goes.

Once I found I could not keep up steam at all, but when I put in my torch I got all the steam I needed, so I used the torch entirely for a week or ten days, and then I began to have the same trouble. I took out the valves and pipes and found them filled up with a yellow, gummy, substance, which was due to using poor gasoline. I cleaned it out and had no further trouble. R. W. J.

## A CHARACTERISTIC DANGER SIGNAL.

ST. LOUIS, August 25.

*Editor* HORSELESS AGE:

Referring to the article "A Signal Needed," which appeared in No. 20 issue, August 15, of your esteemed journal, would call your attention to the invention of a distinctive and characteristic *Approach and Danger Signal* for motor vehicles embodied in a motor vehicle patented several years ago. Said approach and danger signal consisted of an apparatus somewhat like a whistle, into which was placed a little ball, or some other similar object, which, when the wind produced by bellows or air pumps, connected with and actuated upon by the shaft or other parts of the vehicle, or when all or a part of the exhaust from the steam or gasoline motor was allowed to pass into this whistle, would produce a shrill or tremulous sound, for instance, not unlike that of a policeman's whistle. The duration, quality, and strength of tone or sound being produced automatically by the vehicle, at the will of the driver, or other occupants of the motor vehicle. J. J. K.

## WIRE GAUZE SPECIFICATIONS.

BRIDGEPORT, CONN., August 23.

*Editor* HORSELESS AGE:

In the several communications published in back numbers of your paper on the use of wire gauze to prevent explosions in the gas inlets you gave various sizes of mesh to the gauze. What do you consider the best number and how many layers are desirable? Should these lie close together or be separated by a ring? J. H. ARMSBY.

[We would suggest No. 30 mesh. From four to six layers should be used, separated by rings. The separation will economize the gauze, and reduce the dimensions necessary for the enlarged part, in which the layers of gauze are disposed.—ED.]

## NON-VIBRATING STEERING GEAR.

BRIDGEPORT, CONN., August 31.

*Editor* HORSELESS AGE:

In reply to the query of James L. Breese in your last issue, in regard to a steering gear that will eradicate the vibration which is so annoying on rough roads, I will say that the side-steering device now used on the locomobiles has no vibration whatever. I find it possible to leave the hand off the steering bar for some minutes before the carriage is deflected from its course. The steering device is fastened to the carriage body, and, therefore, gets no more vibration than the body receives, which is practically none at all. In my opinion this new side-steering apparatus adds 50 per cent. to the comfort and pleasure of the operator. F. W. BOLANDE.

[Mr. Breese's inquiry seemed to refer to an attachment of some kind to prevent vibration rather than to an entirely new steering gear.—ED.]

## SCARES OF THE DAILY PRESS.

NEW YORK, September 1.

*Editor* HORSELESS AGE:

I am greatly interested in automobiles, and desire to get one, but do not quite know which one to select. In Paris, where automobiles are so much used, I found that steam is considered too dangerous for practical use. Some of the gasoline motors I saw there seem to work fairly well, but none run as smoothly and easily as the light steam carriages which are getting in such general use on this side, and were it not on account of danger there would be no hesitation in one's choice between the two kinds of carriages.

I read with great interest an article in your issue of August 21 on the safety of the boilers used in steam carriages. If I understand the writer correctly, he holds that these boilers are perfectly safe, when in good order and when judiciously managed, but that if incrustation is allowed to take place and if in the hands of careless, incompetent people, partial and even dangerous explosions may occur. He further states that these boilers have been in use too short a time to allow a fair estimate of their life, etc. Almost simultaneously with this article comes the report in the newspapers of the explosion of one of these very boilers in Pittsburg, Pa.: The explosion is said to have taken place when pressure was put on to ascend a hill, and yet the people in charge seem to have been men of presumably average prudence and common sense, and the boiler must have been comparatively new, for very few of these carriages have been in use for over three or four months, and hardly any for over a year.

Now, if we bear in mind that thousands of these carriages are now in use—that the rapidly-increasing demand is being filled by both reliable and unreliable makers—that within a couple of years all the new boilers now in use will have become old, and that these carriages will have been sold and resold into the hands of people less and less careful and competent, and less and less able to spend money for inspection and repairs, a very serious problem stares us in the face. Even if the plants were stationary and used by mechanics for industrial uses, the scattering over the land of thousands of small high-pressure boilers heated by highly-explosive gasoline, would be a subject of serious anxiety.

But the conditions under which automobiles are used are very different:

1—The whole plant is subject to constant and often very violent jolting and racking, which strains the boiler, the burner and the steam and gasoline connections.

2—From the very nature of its use an automobile is frequently, and I think I may say generally, used by inexperienced and often careless people, who have been assured in the most positive manner by circulars, etc., that their own particular machine cannot possibly explode, and who go blindly on, resting on that assertion.

3—Automobiles are mostly used for pleasure and, therefore, often used recklessly, and the older, cheaper and more dangerous the carriage grows the more ignorant, incompetent and reckless will be the class of people intrusted with its management.

4—In all the carriages I have as yet seen the driver sits directly on the top of the boiler, so that even a partial explosion is apt to prove serious.

In view of the above, it seems to me that something should be done to minimize as far as possible the danger to life and limb in case of possible explosions. A carriage should be constructed, not as if an explosion were impossible, but so that in case of disaster the occupants would be as thoroughly protected as the circumstances of the case may possibly allow.

In all the carriages I have as yet seen the boiler and burner are placed under the seat, and are confined at the back by a heavy water tank, so that if an explosion takes place its main force will spend itself upward, just where it would prove most

dangerous. Now, if this order were reversed and the water tank were placed under the seat and made to extend back on both sides of the boiler, enveloping it on three sides, and if the boiler and burner were set as far back as possible, and the occupants of the carriage protected not only by the water tank, which would stand between them and the boiler, but by a strong, high and heavily padded back and seat, the carriage could be used with comparative peace of mind and an almost absolute chance of safety.

The thing would cost no more, and a builder working on such lines must secure the approval of prudent buyers.

Very truly yours, P. G. HUBERT.

[We would remind our correspondent of the proverbial unreliability of the daily newspapers, particularly in matters mechanical. We have it direct from the parties concerned that no explosion took place at Pittsburg, but that the shock of the accident broke the connections of the gasoline tank, causing a fire, which is not of rare occurrence in steam carriages using gasoline as fuel and in gasoline carriages employing the hot tube method of ignition, when accident breaks the tanks or pipe connections. We have yet to hear of an authentic case of boiler explosion in a steam automobile.

## RED FLAG LAW IN VERMONT.

DALTON, MASS.

*Editor* HORSELESS AGE:

Will you be kind enough to answer me through the columns of THE HORSELESS AGE in regard to the probability of my being fined if I should take a trip through the State of Vermont with my "Locomobile." I know the law in that state, but do not know whether they enforce it or not. If you can give me any information it will be appreciated.

FRANKLIN WESTON.

An owner of a steam carriage, Dr. Jo. H. Linsley, of Burlington, writes that he knows of no instance in which the Red Flag Law has been enforced in that state, and that it would be difficult to get a state's attorney to entertain an action against the driver of a steam carriage unless the driver was unusually careless. A movement will be made at the approaching session of the Vermont legislature looking to the repeal of this obnoxious statute.

## THE VICTOR STEAM AUTOMOBILE.

The Victor Automobile Co., Chicopee, Mass., expect to make their first deliveries in September. The Hartford Steam Boiler Insurance Co. insure the boilers of the Victor carriages against explosion. The weight of the 4 h. p. carriage is 750 pounds. Among the claims made for it are the following: Feeds its boiler—variation two inches; keeps pressure within four pounds on fuel tank; regulates its fire; locks when rider is out; on accident puts the fire out; can stand fired up all day; can also be entirely operated by hand—two strings to every bow; climbs all ordinary hills; is safe beyond question.

The following description is furnished by the manufacturers:

"A throttle lever lock prevents the opening of the throttle when the driver's seat is unoccupied, and prevents the wagon being started through carelessness or mischief on the part of passersby when the wagon is standing unoccupied. It practically locks the machine until the driver is seated.

"A fire regulator automatically regulates the fire through the pressure of the steam. It can be adjusted without disconnecting any of the pipes or loosening any of the joints, and regulates the pressure under a variation of 10 pounds.

"The depth of water in the boiler is regulated automatically by a device that cannot get out of order, no floats nor similar devices being used. It is so arranged that it will always supply water to the boiler on level ground, or when going down hill, and will supply water while the carriage is going up hill, if the hill is not very long; but it will do it then when needed.

"This device is connected with the power pump operated by the rear axle, and is thus always ready to pump water when the wagon is in motion.

"By a peculiar construction of the burner, we have overcome a difficulty that so often occurs in other steam wagons—working back of the fire into the interior of the burner (which thus becomes overheated and is often ruined), and may cause an explosion or fire of more or less seriousness. A great deal of time has been spent on this device with entire success. If from any cause the fire should be extinguished and the gasoline continue to flow from the pipe, instead of flooding the burner, it drops to the ground unignited.

"After the fuel tank has been filled and the first supply of air furnished, the pressure is thereafter automatically regulated with a variation of not more than four pounds. If desired, it can be regulated to one-half pound. However little fuel there may be in the tank, the air pressure is always the same. When an extra amount of fire is desired, as is sometimes the case on a steep hill or a bad road, the air pressure can be increased by merely pressing a button.

"By simply closing one valve and attaching a hose to another the tires of the wheels can be refilled by this air pump, and a pressure of 150 pounds can be obtained if desired. This pump is operated by steam from the boiler and works either automatically or at the pleasure of the operator. By adjusting a hose to the suction pipe of this pump and inserting the other end in the vessel from which the fuel supply tank is filled, the tank can be filled without lessening the air pressure, and thus obviate possible danger of fire occasioned by pouring the liquid into the tank from an open vessel.

"The fuel indicator is attached to the dashboard of the wagon, and at all times registers the amount of fuel in the tank.

"There are self-closing valves in the water column, for the purpose of preventing the escape of steam and water. Should the sight glass be broken, these valves are absolutely positive in their action, and a new glass can be put in without losing the water in the boiler or waiting for it to cool. The carriage can, however, be run for the time being without inserting a new glass, the automatic water regulators supplying the water as needed. The water glass is not an essential part of this carriage, but is useful for confirming the regularity of the automatic device.

"To comply with the law, we have introduced a fusible plug in such a way that should the water in the boiler ever fall to within two inches of the bottom (which might be caused by neglect in keeping water in the supply tank), it melts and allows steam to enter a cylinder in which is a piston connected with a valve stem in the fuel pipe. The valve stem closes as soon as the pressure is applied. This instantly shuts off the fuel supply and prevents the boiler from being burned or otherwise injured. Another plug can be instantly inserted without loosening or disconnecting any pipe connection. Should the operator not have another plug at hand, by simply turning a valve and thus supplying water for the boiler, the journey can be resumed with perfect safety.

"A portion of the gasoline is used to keep a constant light, so that if the main fire should be extinguished, from any cause, it will be instantly relighted when the wagon is standing long in an exposed position. This is very desirable.

"The air pressure device can be used for blowing off the boiler, cleaning chain and blowing out retort pipe; and also for blowing out the water in the heater, should that be necessary; as for instance, in very cold weather when the wagon is standing unused. By a connection with the steam pipe, an injector can be used to pump water into the tank from a roadway supply.

"The steam water pump is a perfect steam pump, and is operated by a valve when the wagon is not in motion, or can be operated while the wagon is running, if desired. It is also operated by an excess of steam in the boiler, the valve being in the nature of a safety valve. When the pressure reaches a given point, the pump starts automatically, thus relieving the pressure and at the same time furnishing the boiler with more water.

"The fire accelerator is a device by which the operator can increase the fire without leaving his seat or stopping the wagon. It is very desirable when ascending hills, or on a sandy or heavy road. Also, the fire can be turned down by this device without leaving the seat, the lever being placed where it is convenient for the hand of the operator, and so regulated that no disagreeable blowing-off can occur when the wagon is standing.

"A heater is supplied for the purpose of heating the feed water and also for condensing the steam. Practically no steam is seen when the wagon is in operation and no noise of escaping steam is heard.

"Electric lights in front of the gauges on the dashboard and behind the water glasses, operated by pressure on a button in the steering handle, enable the operator to see the gauges plainly at night.

"All the machinery can be reached without taking out a bolt or screw. The burner can be detached in about three minutes without breaking any joint.

"Fire is started by putting, through a tube in the side of the wagon, a little alcohol into a lighting trough and applying a match. After the alcohol has been burning for about two minutes, the gasoline is turned on slowly and the fire can then be regulated as desired. No torches, hot irons, nor roadside fires are required."

## THE REUTERDAHL STORAGE BATTERY.

The Reuterdahl Electric Co., of Providence, R. I., believes that it has met with a great measure of success in overcoming the difficulties previously encountered in storage battery construction. The Reuterdahl battery, while revolutionary in some respects, is far from being revolutionary in others, as no new materials are used in its construction, and its makers only claim new combinations of the old and tried. The key to its success is the elimination of dead weight and the substitution of active material; that is to say, chemicals as taking an active part in the working of the battery are substituted for lead, which is held to be over sufficient for conducting the current generated.

In storage batteries, as heretofore commonly constructed, the active material is held in openings, grooves or depressions of the lead grids, and is often applied in the form of a paste, made of some compound of lead, litharge or minimum, with dilute sulphuric acid. The grids not only support the active material, but also form the electrodes for conducting the electricity. The area of the openings, grooves or recesses, which contain the active material, is but a small fraction of the entire surface of the grid. As a consequence, the bulk of the weight of a finished plate is made up of the weight of the lead grid and not of the weight of the active material. Storage batteries thus made are heavy and cumbersome, and the disproportionate weight of the grid and the active material is one of the principal objections to their use, and makes them unsuited for many purposes. It is also obvious that the capacities of two storage batteries of the same weight are proportional to the amount of active material they contain, and not to the weight of the lead grids.

The most serious difficulty experienced in storage batteries is that they do not sufficiently support the material which they are intended to hold in position. This material, in general, depends for its support, to a large degree, upon its cohesion to the surface of the grid. When a mass of the active material is

loosened from the grid and projects, bulges or falls outward from the latter, it is liable to come in contact with similarly displaced masses of active material from an adjacent plate, and thus form a short circuit, thereby greatly reducing the efficiency of the battery.

These various difficulties are claimed to be avoided by the method of constructing the Reuterdahl battery. The electrodes of these batteries are not designed to support the active material, but only to conduct the electric current. They, are, therefore, very light, and thus the weight of the battery is reduced to a minimum. The greatest possible area of active material is exposed to the electrolyte, while the possibility of local action is much reduced, owing to the small size of the electrodes.

The active material is held in place by thin sheets of a material which is a non-conductor of electricity. Any effect of the electrolyte upon the active material, changing the form of the latter, is compensated for by the elastic nature of the holding plates, which yield readily to any condition of the mass of the active material, and thus provide an absolute immunity against all buckling or warping of the plates. The holding plates adopt themselves to the uneven expansion of the active material and yet retain their strength and rigidity, and are claimed to be free from all liability to crack or break.

It is generally true that, when the electrolytic action has made the lead grid useless as a mechanical support, the electric conditions of the active material are the best. Hence there is an obvious advantage in using supporting means which will withstand the electrolytic action and retain their mechanical strength and firmness unimpaired. The elastic action of the holding plates, which lie externally to the mass of the active material, surrounding the electrode, and the smallness of the perforations in the holding plates prevent the displacement, loosening or projection of active material, and it is practically impossible for short circuits to be formed. The construction of the battery is such that all parts are readily accessible and detachable, and repairs can, therefore, easily be made when necessary.

The Reuterdahl battery patent covers broadly the idea of a frame work, having on each of its broad sides flexible side pieces, made of hard rubber, or other suitable material, perforated so that the electrolyte will have free access to the active material which is contained within. The officers of the Reuterdahl Co. are: Arvid Reuterdahl, Sc. B. A. M., president; George F. Weston, treasurer, and L. H. Campbell, secretary and general manager.

## THE AUTOMOBILE RACES AT NEWPORT.

The chief event on the cards at Newport at present is unquestionably the coming automobile races, which are to be held at Aquidneck Park, September 6, three and a half miles from the city. Newport society is making active preparations to insure the day being in all respects a great success. Excursions will be made up from various points, and a very large attendance is assured.

A series of second prizes have been offered, which increases the public interest in the result. Additional entries have been made, the complete list so far being as follows:

Gasoline Vehicles—W. K. Vanderbilt, Jr., Cooper Hewitt, James Lanier, The Columbia Machine Works, and the American Motor Co.

Electric Vehicles—A. L. Riker, Lewis DeForrest, Knight Neftel, Mrs. Herman Oelrichs, W. K. Vanderbilt, Jr., The New England Electric Vehicle Transportation Company, Stuyvesant LeRoy and Clarence Dolan.

Steam Vehicles—John Jacob Astor, George I. Scott, M. Muller, S. T. Davis, W. K. Vanderbilt, Jr., The Locomobile Company of America and The Leach Motor Vehicle Company.

Tricycles—Harold Vanderbilt, Royal Phelps Carroll, K. A. Skinner, Mr. Boisiote, Charles S. Henshaw and C. Pinard.

Additional entries are expected.

## THE LEGAL IDEA OF SPEED.

In a recent court decision at Binghamton, N. Y., in the case of an automobile arrest for exceeding the ordinance of eight miles an hour, the policeman making the arrest swore the wagon started from a standstill, and from that point (which was the position of said guardian of the peace) turned a corner, crossed four street railroad tracks, there being two switches at that point, heavily paved with cobble rocks of long standing, crossed a crossing over which people were passing, and came again to a standstill at a point distant from the start of about 500 feet, and within the distance the wagon had traveled at the rate of 15 miles an hour. Four other witnesses were furnished willing to swear that to their best knowledge and belief the wagon was moving under five. As the wagon was moving directly from the policeman over such a course, and was fitted with small tires and 28-inch wheels, considerable surprise was in evidence at the willingness of the witness to swear to a statement so almost impossible. Automobilists in the city were at once impressed with the ridiculousness of it. Then, again, the case shows the unwillingness of these "arms of the law" to permit the inevitable and the wide discrepancy shown at such examinations when it comes to a question of speed.

## AUTOMOBILIST LOSES CASE.

Damages have been awarded to Daniel Platt, of Patchogue, L. I., in his suit against Wilson R. Smith, a New York merchant. Platt and his wife were driving on July 3 at West Patchogue, when they met Smith in his automobile. Platt's horse, at sight of the machine, became unmanageable, and ran away, and Platt and his wife were thrown out. Mrs. Platt, it is said, was hurt severely. Platt asked for $170 damages, and was awarded $120. Mrs. Platt, it is said, will bring a suit on her own behalf.



## MINOR MENTION

The Winton Motor Carriage Co. has opened a Chicago office in the Monadnock block.

The Canada Cycle & Motor Co., Toronto Junction, Canada, are putting out a line of motor tricycles and quads.

The New York Automobile Co. are reported negotiating for the purchase of the Worcester plant at Middletown, Conn.

The Rose Polytechnic Institute, of Terre Haute, Ind., will devote special attention to the automobile in its course of study.

H. C. Baker, of Hartford, Conn., is reported to have interested New London capital in his motor vehicle, and to be about to start a factory there.

The Locomobile Co. of America are pushing work on the mail wagons they are building for the government. An additional order for seven has been received.

The Pennsylvania Railroad is said to be the only ferry company around New York that is enforcing the law against the carrying of gasoline on harbor vessels.

The New York Post Office department reports a saving of 15 minutes per trip as a result of its tests with motor vehicles for the collection of mail in the downtown districts.

The authorities of the village of Southampton, L. I., have passed an ordinance limiting the speed of automobiles within the limits to seven miles an hour, under penalty of a fine of $25.

The De Dion-Bouton Motorette Co. have opened a branch office in New York, in the St. Nicholas Rink Bldg., West 66th street, near Columbus avenue, under the charge of C. S. Henshaw.

C. G. Wridgway, traveling representative of the De Dion-Bouton Motorette Co., is this week covering the territory between Albany and Syracuse. The first week in September will find him in Rochester and Buffalo.

Messrs. Safford and Bradbury, of the Stanley Mfg. Co., Lawrence, Mass., recently drove two of their new steam carriages from Boston to Torrington, Conn., accompanied by the purchasers, two gentlemen of the latter city.

The Worcester (Mass.) Automobile Club has been organized with 17 members. James E. Farwell is president; James W. Bigelow, vice-president; Henry F. McKnight, secretary and treasurer, and W. A. Sutton, chief marshal.

C. H. & F. E. Mason, Rochester, N. Y., who obtained judgment against J. B. West, of the same city, for damages due to a runaway caused by the latter's automobile, have appealed from the reversal of the County court. The original decision was in favor of the Masons, but this was reversed by the County Court.

Francis D. Carley, one of the head promoters of the $75,000,000 Anglo-American Rapid Vehicle scheme, is reported missing. Penningtion, another ringleader, is in London, dazzling the long-suffering English public again. Lawson has also returned to his native heath, and in consequence of these wholesale desertions the Anglo-American office, at 20 Broad street, New York, is said to be closed.

W. L. Bodman, formerly of Simpson & Bodman, Manchester, England, whose newly-formed connection with the Milwaukee Automobile Co., Milwaukee, Wis., was recently reported in our columns, expects to have a steam omnibus, embodying his invention, completed by next November. He returns to Europe this month to settle up his affairs prior to making his permanent home in the United States.

It is the intention of the Automobile Club of America, at their show in the Madison Square Garden next November, to exhibit a number of racing automobiles, as well as a number of foreign carriages. They also wish to add to their exhibit any early experimental motor carriages which they can find, as they believe these will be of considerable historical interest. Parties having such relics in their possession are requested to communicate with A. R. Shattuck, Chairman of the Exhibition Committee, 11 Broadway, New York.

In our issue of August 22d we made Dr. Kingsley the agent of the locomobile for Vermont. It should be Dr. Jo. H. Linsley, of Burlington.

E. E. Schwarzkopf has resigned as editor of the *Automobile Magazine*. The Greater Inter-State Fair of Trenton, N. J., of the automobile department of which he is manager, has opened a New York office at Room 60, Astor Court Building, 25 West 33d street. All the space allotted to automobiles has been taken, and an annex is contemplated.

The Hampden Automobile & Launch Co., capital $100,000, has been organized under Maine laws by J. Frank Duryea, Springfield, Mass.; William C. Eaton, Portland, Me., and Addison L. Green, of Holyoke, Mass. J. Frank Duryea is president and treasurer of the company.

An automobile club, with 10 members, was organized at Montclair, N. J., last Wednesday night.

The Plainfield (N. J.) council has passed an ordinance to license competent automobilists under the same rules governing horse vehicles as to speed and right of way and bicycles as to lamps and gongs.

The St. Louis Automobile & Supply Co., St. Louis, Mo., who claim to be the first company in the world to start an automobile supply business, have issued a catalogue of their various gears, transmissions, engines and complete vehicles. They aim to handle nearly everything that enters into the construction of an automobile, and make a specialty of their complete running gear, improved gasoline engine and transmission, which they sell to experimenters or those who wish to build vehicles for themselves.

## THE KEYSTONE THREE-SEATED AUTOCYCLE.

We illustrate herewith the latest addition to the regular product of the Keystone Motor Co., of Philadelphia. It is the third type of vehicle they have placed upon the market. They have some regular delivery wagons and "Wagonettes" under way, but so far the vehicles which they have marketed consist of the standard "autocycle," the parcel delivery wagon, and the three-seated "autocycle."

The three-seated autocycle is simply a standard autocycle elongated 16 inches, with the addition of a seat placed over the motor for the operator. The frame is made of 1½-inch steel tubing $\frac{3}{16}$-inch thick. The wheels are 30 inches and 34 inches diameter, fitted with 2½-inch pneumatic tires. The spokes are $\frac{3}{16}$-inch wire-laced tangent. The rear axle is 1⅝ inch diameter, and is carried in self-adjusting bearings—insuring at all times perfect alignment of the driving shaft. The front axle has a slight movement around a king-bolt in the vertical plane to compensate for the irregularities in the road. This arrangement prevents any twisting or distorting of the frame when travelling on rough roads.

The motor is one of the Keystone standard 4 x 4-inch engines. This motor is stated to deliver a two-brake horse-power at 400 revs. per minute and four horse-power at 800 revs. It is completely controlled from the driver's seat. A small lever regulates the speed, and the clutch and back gear mechanism are also controlled from this seat.

Two changes of gear are provided. A gear having a ratio of five to one will give a maximum speed, on good roads, of 20 miles per hour; while the hill-climbing gear will give a maximum speed of six miles per hour. Intermediate speeds are obtained by shifting the ignition.

The circulating water is carried in a four-gallon copper tank, and in addition a heat radiator is provided. Water enough is carried for a 10-hours' continuous run. The tread may be made standard when desired; when not specified, however, it is always four feet, and the wheel base is four feet, six inches.

The Keystone Motor Co. has been making extensive arrangements for manufacturing these vehicles, which they believe will prove as popular as their standard autocycle.

A Scene in Front of the Store of the St. Louis Automobile & Supply Co., St. Louis, Mo.

THE KEYSTONE THREE-SEATED AUTOCYCLE.



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NEW YORK, May 7 1900

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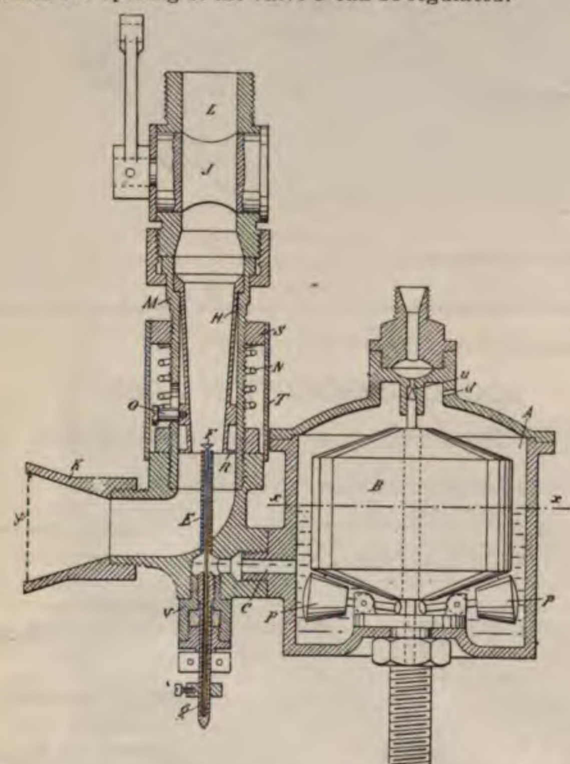
DESBERON MOTOR CAR CO.

# MOTOR VEHICLE PATENTS ∴ ∴ OF THE WORLD ∴ ∴

## UNITED STATES PATENTS.

656,797—Carbureter for Petroleum and other Engines.—A. & L. Lumiére, of Lyons, France. August 27, 1900. Application filed March 27, 1900.

This is a carbureter of the constant level type, the constant level being obtained by means of a float B, and counterweights P, P. From the constant level compartment, the liquid to be vaporized, passes through a passage C and through the vertical tube E to a reversed, truncated, conical chamber H. The upper end of the tube E is somewhat higher than the level of the liquid in the constant level compartment, and when the apparatus is at rest, there is, therefore, no flow of gasoline. At the upper end of the tube E there is a small conical valve F, the rod of which passes at the bottom of the closed tube g, screwed into the bottom of the stuffing box v, and by the aid of which the opening of the valve F can be regulated.



The exterior air is drawn in through the funnel K, and has to pass through layers of metallic cloth indicated by y. The suction of the piston draws the liquid to be vaporized up to the valve F, where it issues in a thin, conical sheet. The air breaks up the sheet, and vaporizing the liquid, carries it along to the cylinder of the engine. The composition of the mixture is regulated, once for all, by adjusting the opening of the valve F. It, therefore, suffices to regulate the speed of the motor by means of the cock J. When, by accidental excess of speed, the suction of the motor passes a certain limit, the suction of the petroleum will be increased; but in this case, the pressure exerted on the flange R, at the base of the chamber H, raises this chamber, compressing the spring N. The valve F, therefore, remains below the smaller end of the cone, and the suction of the petroleum is suspended until the speed, having again become normal, the chamber H again descends to the position shown in the drawing.

656,203—Low Water Alarm for Steam Boilers.—Samuel L. Moyer, of Cincinnati, Ohio. August 21, 1900. Application filed June 25, 1900.

Describes a low water alarm, of the type in which a tube extends into the boiler, its lower end extending down into the water of the boiler to the low water level. In case of low water the steam passes up the tube and operates a whistle.

656,215—Motor-Car Driving Gear and Gear-Changing Device. Alfred Rawlinson, of Winwich Warren, Rugby, County of Warwick, England. August 21, 1900. Application filed January 9, 1900.

The invention relates to a speed-changing device for motor vehicles. It consists in operating the clutches connecting the several gears of a motor car with the driving axle, by means of a gear shaft operated by a foot or other lever. A number of cranks are provided on the gear shaft, and a corresponding number of links, with suitably shaped ends, adapted to be perated by the cranks, each link being provided with means to operate one of the clutches. The cranks are so disposed in relation to the positions of the link ends that only one crank

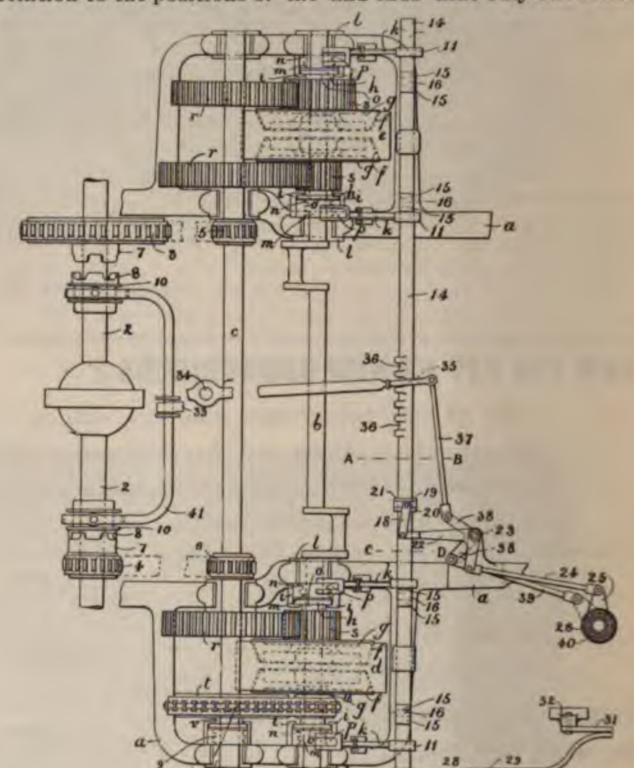


Fig. 2.

can be in a position to operate its link at one time, and the gear shaft is adapted to be moved longitudinally by a suitable mechanism. By moving the gear shaft to a certain position, one crank will be chosen, and when the foot lever, or other gear shaft operating lever is moved, or let go, one clutch only will be put into gear. In the drawing, b is the motor shaft which carries on its two extensions, three spur pinions and one sprocket pinion. All the pinions are connected to friction clutch members. The countershaft c carries gears and a sprocket wheel corresponding to, and engaging with, the pinions on the motor shaft. On the motor shaft there are also two flywheels d and e, and these flywheels serve at once the purpose of the tight part of the friction clutches, which latter are of the conical type.

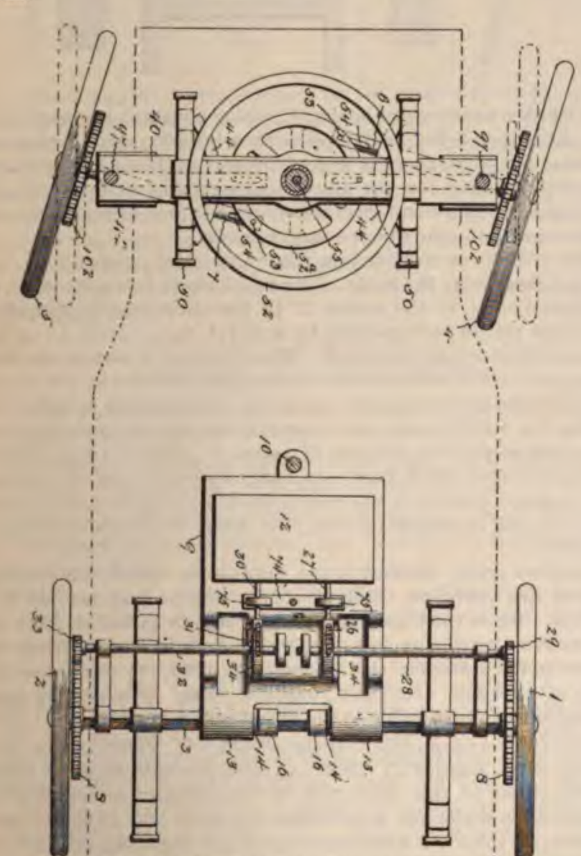
The motor shaft b passes through bushes l, in the frame a, and a continuation m of each bush is screwed and inclosed in a nut n, to which are attached clips l, which catch a flange o on each sleeve h. A rotation of the nuts n will slide the sleeves h along the shaft, and put the clutches in or out of gear. The nuts n have each an arm p, to the end of which the links k are pivotally connected, and also an arm y, to which the spring 27 is attached.

The sprocket wheel t is mounted on a sleeve v, which is slid along the countershaft by means of a screwed bush w, and a nut 9, in a manner precisely the same as the sleeves on the motor shaft. This latter arrangement serves to keep the sprocket wheels in line when the sprocket pinion is clutched to the motor shaft. The nut 9 has an arm x, and its adjacent nut n on the motor shaft has an arm y. x and y are pivotally connected to the ends of the link z, by which means their motions are identical.

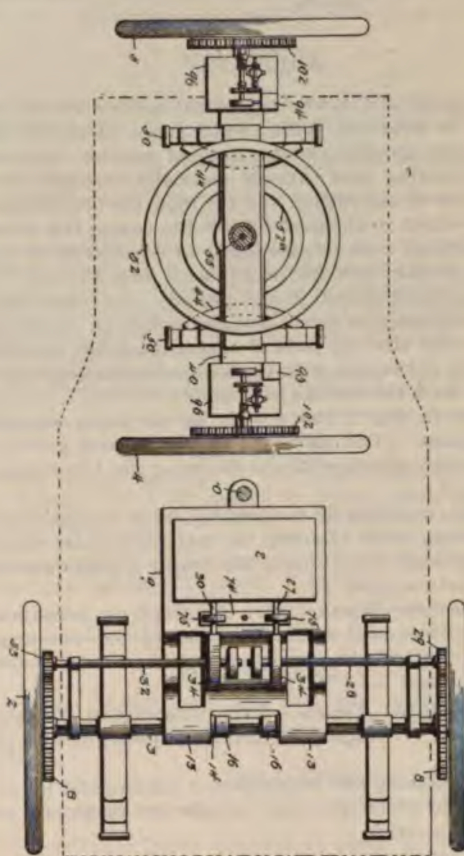
The driving axle 2 carries two chain wheels, 3 and 4, which are driven by chains connecting them with chain wheels 5 and 6 on the countershaft c. The chain wheels 3 and 4 are loose on the axle, and are formed with projections 7, adapted to engage with the jaws 8 of positive clutches 10. These clutches 10 are keyed to the axle with a loose feather key, so as to allow of longitudinal, but not of rotary movement, relatively to the axle. The method of operating the friction—and positive clutches can be easily followed in the drawing, and it will be noticed that only one of the friction clutches can be in gear at a time.

656,389—Motor Vehicle.—Patrick J. Collins, of Scranton, Pa. August 21, 1900. Application filed December 18, 1899.

The invention comprises improvements in propelling and steering devices for electrically operated vehicles, which permit to use high speed motors, having light weight and high efficiency, and to readily control the vehicle under all conditions.



The motor 12 consists of a hollow rectangular field frame having at its opposite ends inwardly-projecting pole pieces 17 and 18, provided with field coils 19 and 20 respectively, and a removable partition 27, arranged midway between the pole pieces and forming part of the magnetic circuit. This partition has on its opposite sides short pole pieces 22 and 23, whic are opposed to pole pieces 17 and 18. In one compartment o



the motor, between poles 17 and 22, there is an armature 24 and an armature 25 is similarly arranged between pole pieces 18 and 23. It will be seen that when current is sent through the field coils, consequent poles will be set up in the short pole pieces, and that the armatures may be operated and controlled independently of each other. The motor is designed to develop a high armature speed, and power is transmitted to the wheels through the medium of worm gears.

The motor is placed upon a support, which is journaled on the rear axle, and at its outer end spring suspended from the vehicle body. On this support are also fastened the bearings and casing for the worm gear. Each of the two armature shafts carries a brake pulley 75, and a worm. The worms engage each with a worm wheel on intermediate shafts 28 and 32, and pinions at the extremities of these shafts engage with spur gears on the hubs of the driving wheels. It will be seen from the illustration that armature 25 drives wheel 1 and armature 24 independently operates wheel 2.

The forepart of the carriage is supported upon an axle casing, consisting of flat top and bottom pieces 40 and 41, and united at their ends by short side pieces 42, suitable springs 50 and a fifth wheel 52 being arranged between the body and the casing. The casing is supported by half axles 6 and 7, which extend longitudinally therein, the axles being pivoted near the outer ends of the casing in trunion blocks 43, so that they may swing in horizontal planes, the inner ends of the axles being guided

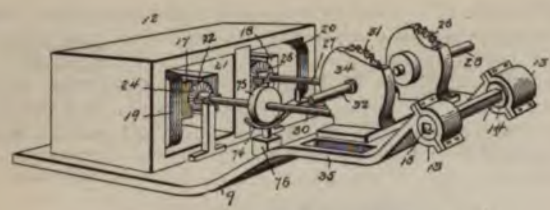


FIG. 5.

between upper and lower segmental guideways 44 and 45. Each axle is provided with a fixed guide block 46, between which and the guideways are arranged suitable ball-bearings. A hollow steering post extends vertically through the center of the top 40 of the casing, and through the foot board of the casing. Secured to the post within the casing is a wheel 52a, having vertical pins 53, arranged at diametrically opposite points. The half axles are formed with slots 54 (Fig. 1) at the inner ends, which extend longitudinally and vertically there through, and the pins pass through these slots. It will be seen that when the steering post is turned in either direction, the engagement of the pins with the half axles will throw the latter out of line with the casings in opposite directions, as indicated in full lines in Fig. 1, the wheels at all times remaining in parallel planes. (The operation of this steering gear is, therefore, not in accordance with the theory of the Ackermann steering gear.)

The speed controller 68 is operated by a vertical movement of the steering lever. During the last part of its downward motion this same lever opens the motor circuits and throws the brake into action.

The patent specification also describes an arrangement of switches, by means of which the speeds of the two armatures are varied relatively to each other for the purpose of steering.

(Figs. 1, 3 and 5.)

656,396—Motor Vehicle.—John Washington Eisenhuth, of New York, N. Y. August 21, 1900. Application filed September 8, 1899.

Refers to steering and transmission mechanisms for an automobile cab, in which the rear wheels are employed both for driving and steering.

656,483—Motor Vehicle.—Walter Scott, Plainfield, N. J. August 21, 1900. Application filed February 25, 1898.

The invention relates to improvements of running and steering gears of motor vehicles. In the drawings a vehicle is shown having a vertical motor in front, with its shaft running longitudinally with the vehicle. A shaft running all the length of the vehicle is connected to the engine shaft by means of a universal coupling, and gears with the differential on the rear or driving axle by means of a worm-wheel gearing. Some of the claims refer to the steering gear, which is of an irreversible type, worms and wheels being used in it.

656,539—Multiple Cylinder Gas Engine.—Russell A. Frisbie, of Middletown, Conn. August 21, 1900. Application filed December 19, 1899.

This is an air-cooled cylinder engine, the two cylinders being arranged in tandem and cast integral. The engine is specially intended for bicycles and other light vehicles.

The cylinder casting has a partition a, which divides the inner space into two compartments or piston chambers, A and $A^1$, and at one side of the cylinders is an integral projection $a^1$, supporting the gas inlet and exhaust valves for the lower piston chamber. This projection has a straight, horizontal chamber c, communicating with the upper end of the lower apartment, and internally threaded at its outer end to receive an igniting device. Communicating with the chamber c is a valve casing D, forming the lower part of the projection $a^1$ of the cylinder casting, and this casing contains the exhaust valve $D^1$. The upper part of the projection $a^1$ contains a stepped opening, to receive the valve casing E, which contains the inlet valve $E^1$, the casing being held in place by a bolt F passing through a threaded opening in a lug $a^2$ projecting from the cylinder. The valve casing for the upper compartment is cast integral with the cylinder head, and is similar to, and in line with the valve casing for the lower compartment.

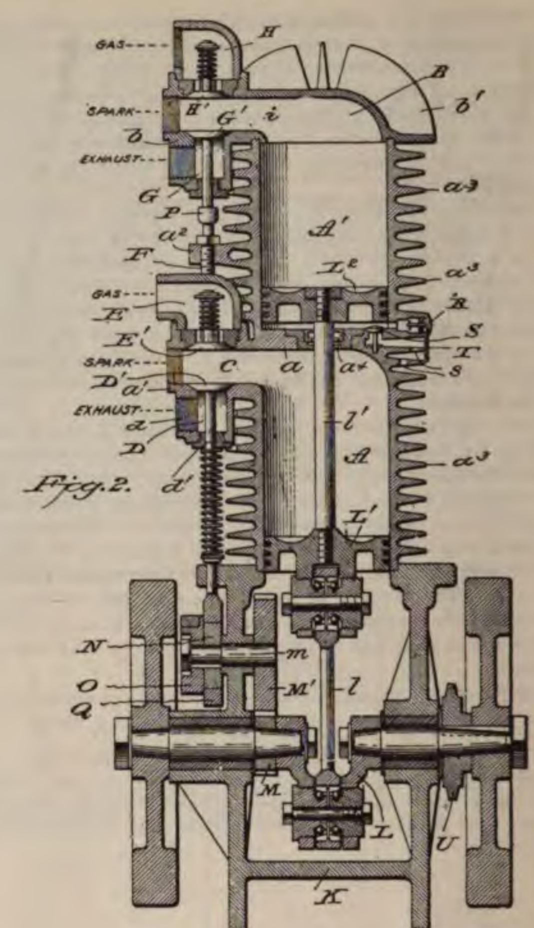


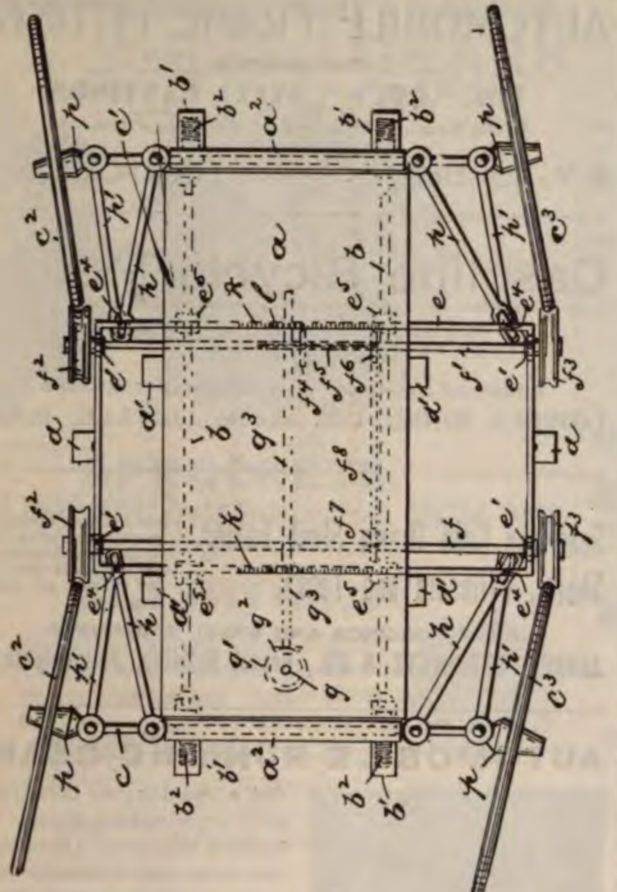
Fig. 2.

The cylinder is mounted on the crank frame, and rigidly connected thereto by the bolts. The crank shaft L is connected, by a pitman rod l, to the piston $L^1$ in the lower piston chamber, and this piston is connected, by a rod $l^1$, to a piston $L^2$ in the upper cylinder compartment. Where the rod $l^1$ passes through the partition a thimble or bushing, $a^4$, surrounds the same. To keep the partition, and especially the bushing forming the guide for rod $l^1$ cool, the lower space of the upper piston chamber serves the purpose of a sort of reciprocating blower, being provided with two opposing valves, S and R. During the upward motion of the piston, fresh air is drawn in through valve S, and is expelled by way of valve R during the return motion.

Another point claimed is the manner in which the exhaust valves are operated. Only a single cam is used for the two valves. When the high point of the cam is on top, it lifts the exhaust valve of the lower cylinder from its seat. When the same point occupies the opposite position, it depresses one arm of a double arm lever, and the other arm of this lever raises the exhaust valve of the upper piston chamber.

656,491—Automobile Vehicle.—Waldo W. Valentine, of New York, N. Y. August 21, 1900. Application filed March 9, 1900.

The object of this invention is to secure a construction by which an open space is provided between the adjacent peripheries of the front and rear wheels, on the same side of the vehicle, to provide means when the vehicle is rounding a curve



for throwing the running wheels on the inner side of the curve out of engagement with the driving wheels. As will be seen from the drawing, the vehicle has a friction transmission, the friction rollers engaging the rims of all four wheels. All four wheels are also used for steering purposes. By means of a system of distance rods between the two axles and a frame supporting the bearings of the countershafts, the friction rollers on one side of the vehicle are brought out of contact with the wheels, thus serving the function ordinarily performed by the differential gear.

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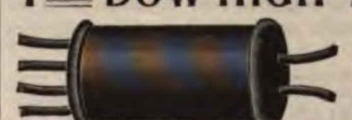

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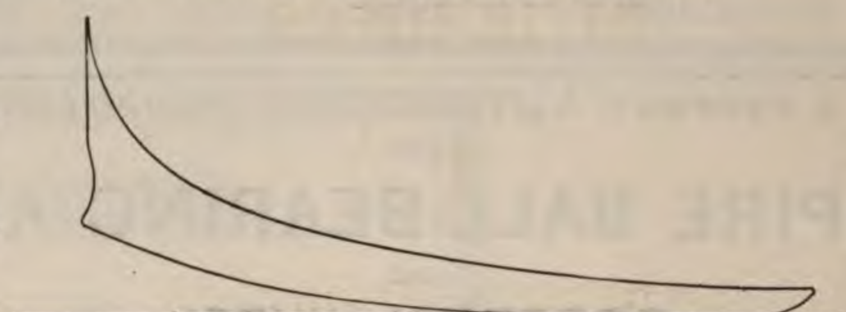

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## GASOLINE CARRIAGES AND FEMININE DRIVERS.

IN a recent issue we noted the fact that no licenses had been granted to women to operate steam or gasoline carriages in Chicago, and that these vehicles are there considered unsuited for use in feminine hands. That this opinion is not held in Paris our readers do not need to be informed, and by present indications the limitation is already being overpassed in England. Two ladies who handled motor carriages with conspicuous success in the 1,000-miles trial in England were Miss Weblyn and Mrs. Edward Kennard, the former of whom won the ladies' race at the recent Ranelagh Club gymkhana. Mrs. Kennard, who is best known in England by her novels, has driven every style of carriage from a motor bicycle to a big Daimler, and Miss Weblyn, not long ago, drove Grahame White's 12 h. p. Daimler a distance of 140 miles, and absolutely alone.

Mrs. Wegulin, whose husband we believe, owns a 12 h. p. Panhard, is another lady operator who does not fear to guide her vehicle through the mazes of city traffic; and quite recently was reported the feat of Miss Vera Butler, who drove her father's well-known Panhard from London to Paris unattended.

There is really no reason why, within the limit set by their physical strength, women should not handle automobiles as successfuly as men. The ignorance of mechanical matters, so nearly universal among the sex, is traceable more to lack of interest than to lack of ability. The success of women in the mathematical and scientific branches is well known, and they need only the spur of an active interest to enable them to conquer the mechanical world as well. Doubtless, when it comes to break downs, that familiarity with tools which comes like second nature to the mechanically inclined man will need to be called into service; but so far as handling the vehicle goes, there is no reason why, with equal opportunities, either sex should give points to the other. Woman's handicap has been lack of opportunity, through preoccupation in other fields, rather than lack of natural gifts.

It may, perhaps, be objected that the gentler sex lacks the nerve and coolness necessary to place them on a par with men in a test requiring the exercise of these qualities. It is probably true that in a prolonged effort the woman's reserve of nervous force is sooner exhausted than the man's; but it should not be forgotten that a great deal of the common feminine timidity in driving, boating, traveling, and in emergencies and perils on land and water, is due simply to the woman's lack of familiarity with the forces, mechanisms, and safeguards involved. No one blames the woman who knows that canoes upset, but has not learned how to sit in them, for being chary of trusting herself to these delightful but kittenish craft: and who can wonder at the man or woman who, knowing nothing of sail boat stability, or of seamanship, views with mistrust the cat-boat keeling far over in the September gales, flinging the spray from her bows and wetting her lee rail in every wave?

We respectfully submit that any woman who gives satisfactory evidence of her ability to handle a motor carriage and of her familiarity with its workings, is *ipso facto* entitled to full liberty to run the same, and that where license laws are in force she has as much right to a license as a man under the same conditions.

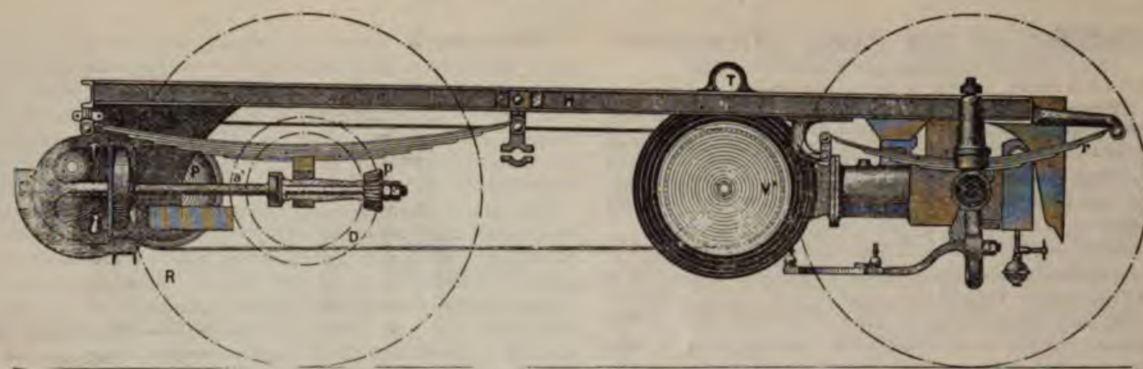


FIG. 2.—ELEVATION OF FRAME OF DE DIETRICH GASOLINE LORRY.

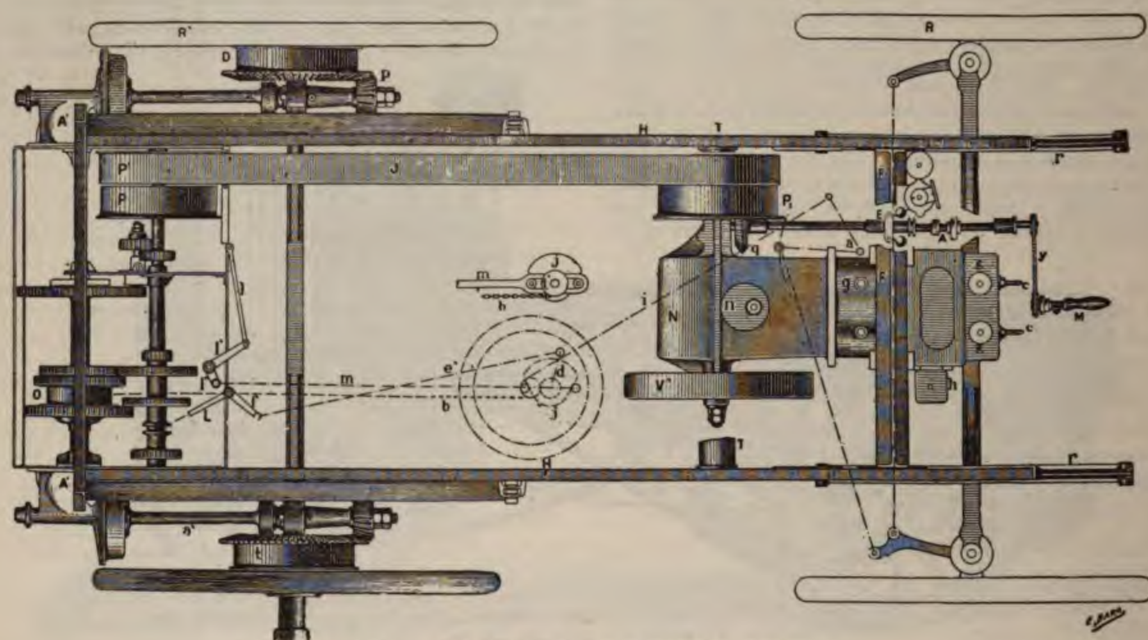


FIG. 3.—PLAN OF DE DIETRICH GASOLINE LORRY.

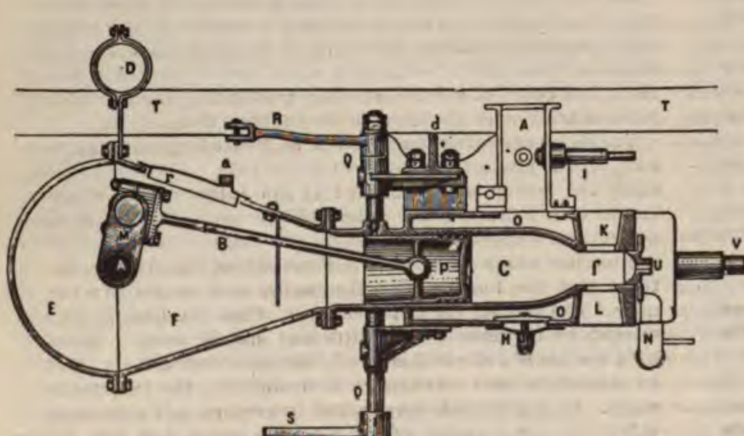


FIG. 4.—AMEDEE BOLLEE ENGINE.

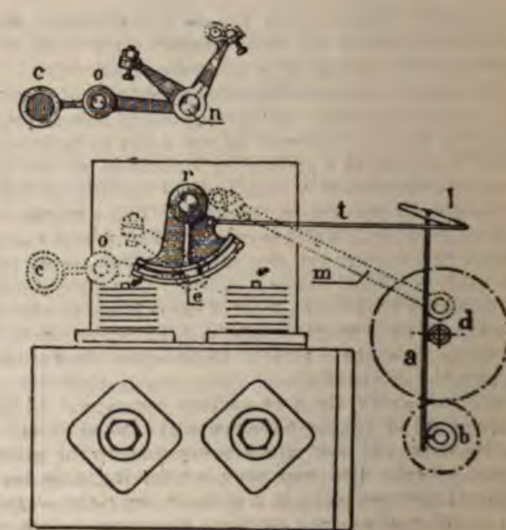


FIG. 5.—GOVERNOR MECHANISM OF ENGINE.

extra pinion on a shaft, having a bearing at the end of a single arm lever. When it is desired to run backwards, the gear carriage is shifted into a position where all of the gears are out of mesh. The low-speed pinion and gear are then right beside of each other. The extra pinion, just referred to, has the same breadth as the low-speed pinion and gear together. It is swung around on its pivoting shaft, which is parallel with the shaft on which it turns, and connects the slow-speed pinion with the slow-speed gear. The motion obtained in this manner is, of course, reversed. The differential casing forms a brake drum, as is usual in French automobiles.

The differential shaft is connected to the drive wheels by means of two shafts running lengthwise of the vehicle, and carrying bevel pinions at their ends. These shafts, which are in two parts, connected by a universal joint, pass through the center of the rear stationary axle. The axle is worked into a loop at this point, into which fastens a long bronze bearing box. Combination bevel gears and brake drums are bolted to the spokes of the drive wheels.

The motor is started by a ratchet crank on the valve-operating shaft. While starting, the intake valves are lifted from their seat by means of a lever.

The method of driving the wheels through bevel pinions and gears permits of giving them the usual dish employed by carriage builders, which considerably increases their strength.

The building devoted to cyclism, at Vincennes, also contains quite a few auto-tricycles and voiturettes. There may be found the very ingenious and original tricycle, motor and parts of Renaud, recently described in THE HORSELESS AGE, light vehicles of the Clement Cycle Works and other firms. In the Italian section of this building are seen a tricycle with two motors and a voiturette similarly powered, both manufactured by Prinetti & Stucchi, of Milan, Italy. (Illustrated in Aug. 29, and Sept. 5 issues of HORSELESS AGE.)

The two engines are in each case placed side by side, and have the center lines of their crank shafts in line. The two crankshafts are coupled together mechanically, and the action is, therefore, that of a double-cylinder engine. There is an advantage over the ordinary twin-cylinder engine, in that the facility for heat radiation is increased, on account of the distance apart of the two cylinders, which, as the motors are air-cooled, is of prime importance.

In the motor tricycle, a pinion on the engine shaft, between the two engines, engages directly a gear on the differential, the latter being placed on the axle. The transmission is, therfore, ideally simple, but, unfortunately, this cannot be said of the control. There are six little handles along the upper longitudinal tube of the tricycle, and a couple of brake-operating levers on the the handle bar. Adding to this the handle bar itself and the current interrupting switch, we have nearly a dozen of controlling levers, and the rider of such motor cycles may sometimes feel that two hands are rather insufficient for operating a racing machine *fin de siecle*. It should be added, however, that the Pirnetti-Stucchi machines have carried off many prizes in contests on the track and on the road, the latest occasion on which they covered themselves with glory having been the races at Padua, during the last week of June, at which voiturettes and quadricycles of this firm obtained first prizes, while the tricycle secured both the second and the third place in its category.

In the voiturette, the two motors are placed in front, and are supported by the spring suspended tubular frame. On the shaft, between the two motors, are fastened a pulley and a sprocket wheel. The rear axle is a driving axle, having the differential fastened upon it, a little to the right of the center. With the differential gear meshes a pinion on an intermediary shaft, the center line of which is in front of, and somewhat higher than the axle. A second intermediate shaft is located below the first one, and connects with it through spur gearing. This last-named shaft is supported by bearings on arms swivelling around the axis of the first intermediary shaft. The second

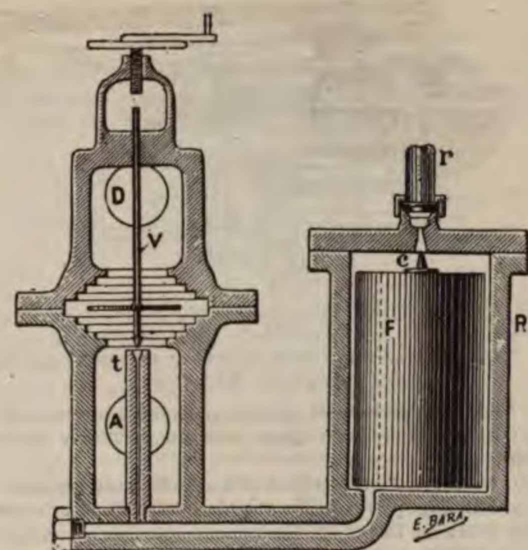



FIG. 6.—DE DIETRICH CARBURETER.

intermediate shaft carries a pulley, and a belt connects this one and the pulley on the engine shaft. By means of the swiveling bearing arms, and a coil spring, uniting their extremities, and a fixed point on the casing over the differential, the tension of the belt can be regulated at will. When it is desired to disengage the motors from the gearing, a foot lever is depressed, which counteracts the force of the coiled spring, and thus releases the tension of the belt. To prevent the belt from leaving the pulleys when the tension has been released, the latter are constructed with flanges on both sides.

There are two sets of spur gears connecting the two intermediate shafts, the two gears, on what has been referred to as the first intermediate shaft, running loose upon it. A ratchet clutch will engage one or the other of these two gears, and thus two mechanical speeds are obtained.

The gasoline tank is placed under the seat of the vehicle. The gasoline flows by gravity to the carbureter in front near the engine. Near the steering post, a valve is placed in the gasoline piping, which can be opened or closed by a hand lever on the steering column. Steering is effected by a cranked steering lever, the shaft of which passes up through a tubular column, fastened to the vehicle body. Around this column are grouped the levers for changing the gear, for regulating the carburation, and for advancing the ignition. A foot lever similar to the one by means of which the tension of the belt is released, operates a brake, and another brake is operated by a hand lever.

As will be seen from the drawing, there is a sprocket wheel on the shaft between the engines in addition to the pulley. A chain passing over this sprocket wheel connects the engine shaft to a starting shaft.

The frame is of steel tubing, spring suspended in front, but fastened directly to the bearings in the rear. The body is suspended by C springs.

The method of speed changing almost entirely used in heavier automobiles, and also to a large extent in voiturettes, is what is known as the gear carriage method. This method permits obtaining from three to five different speeds with a speed change mechanism of comparatively simple construction. But this is about the only advantage of the system, the practice of engaging spur gears sideways while in motion, not appealing very forcibly to the mechanical mind. The gears, as a rule, do not catch immediately, and they then produce that familiar sound which in English spells something like "shrrrr," and which is expressive of a very destructive action on the teeth of the gear wheels. The extensiveness with which this system is used here would indicate, however, that for the conditions obtain-

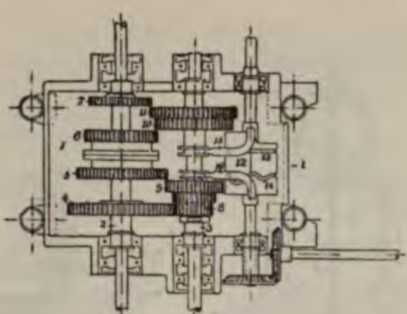


FIG. 7.

FIGS. 7 AND 8.—PLAN AND SIDE VIEWS OF AUDIBERT-LAVIROTTE SPEED-CHANGING MECHANISM.

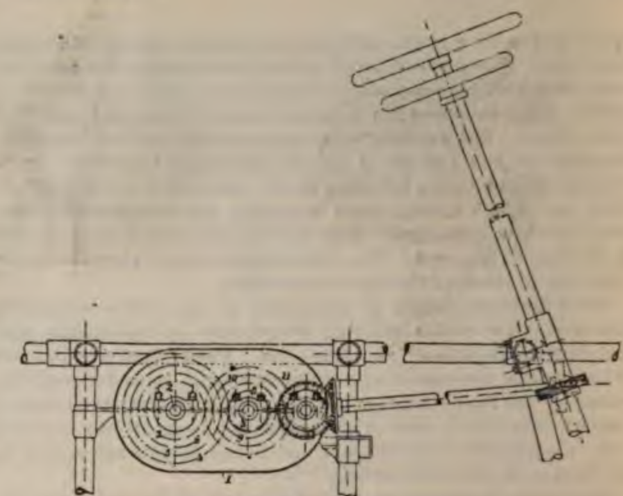


FIG. 8.

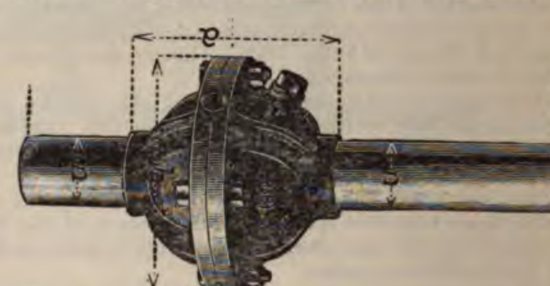
ing in France, it is the best system actually known, and that its use will continue until some radically different method is invented.

We show herewith two views of a speed-changing device, on the gear-shifting principle, but which has some advantages over the ordinary forms of construction, requiring, as it does, less room sideways for a certain number of gear changes, and permitting to go from the high-speed gear directly to the low-speed gear. This speed-changing device is used on the Audibert Lavirotte vehicles, exhibited at the Champ de Mars and at Vincennes.

The mechanism consists of two parallel shafts, one of which carries four gears keyed to it, and the other one two sleeves, to one of which are fastened two gears, and to the other one three. A third shaft, parallel with the other two, carries a drum, on the cylindrical surface of which are turned two grooves, partly undulating and partly straight. Each of the two sleeves is provided with a groove, in which engages a shifter lever. These two levers are guided by the grooves on the drum of the third shaft. When the drum is turned, the gears are engaged and disengaged, one after another, one of the sleeves being stationary while the other is being slid along the shaft, and vice versa. The drum shaft is connected by bevel pinions to a longitudinal shaft, which carries at its other extremity a helical gear, engaging with a similar gear on a sleeve concentric with the steering shaft, and operated by a hand wheel just below the steering hand-wheel. The gear operating hand-wheel has four spokes, on which are cast the Roman numbers I, II, III and IIII, the number on the spoke turned towards the operator indicating the gear in mesh.

All the mechanism is enclosed in a case, which is absolutely dustproof.

The firm of Malicet & Blin exhibits in the automobile section of the Exposition differentials, change-speed gears, worms and wheels for steering gears and general work in the gear cutting



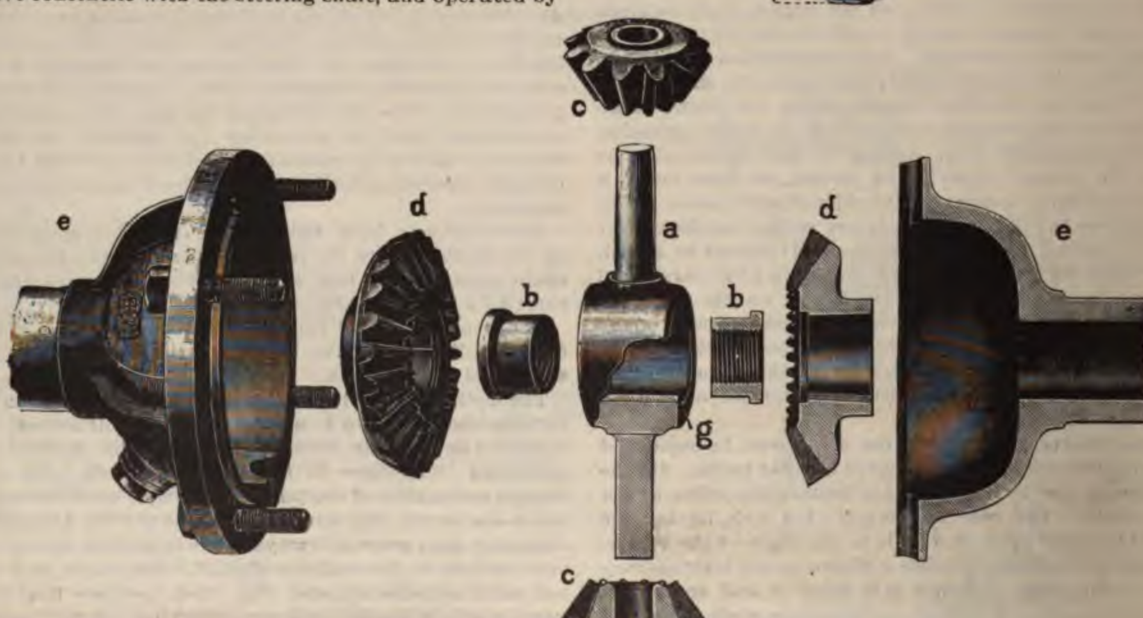




FIG. 9.—MALICET & BLINS' DIFFERENTIAL GEAR.

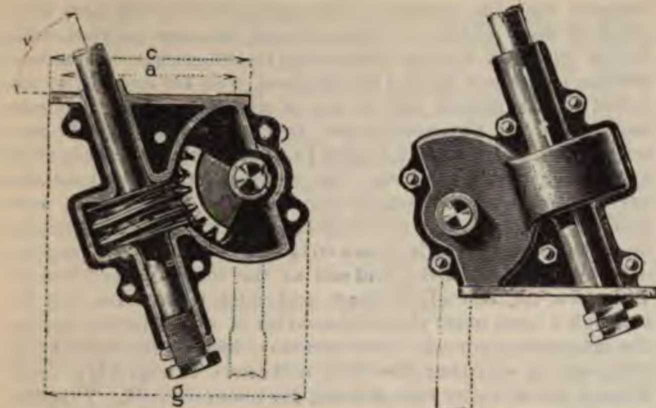


FIG. 10.—M. & B. STEERING GEAR REDUCTION MECHANISM.

line. The differential, herewith illustrated, is of the type generally used in France on vehicles with chain transmission.

It will be seen that the gear is entirely dustproof. The two hemispherical cover castings are turned, one with a groove, and the other with a shoulder, fitting into the groove. The two halves are held together by means of four cap screws. The two bevel gears d, d have a taper bore and keyways. They are keyed to their respective shafts, and are drawn up on the shafts by means of screw bushings b, b. These bushings fit into a bronze sleeve in the cross arm a. The tubes n, n, once they have been cut to their right length, are chambered out, internally, to prevent gripping. When in use, the case of the differential is filled with vaseline, a plug-closed opening, for the introduction of the latter, being visible on one of the covers. These differentials are constructed with 2, 3 and 4 satellite pinions. It is stated that the greater the number of these pinions, the less will be the size of the gear for a certain power and angular velocity.

The same firm also exhibits a worm and wheel reduction for steering gears. This appliance is intended for use in connection with a steering hand-wheel and an inclined shaft. A worm, keyed to the steering shaft, engages with a worm wheel sector. On the shaft of the worm-wheel sector, outside the case, is keyed a one-armed lever, which connects to a lever arm on one of the steering spindles. The gears are enclosed in an aluminum case, which is also filled with heavy grease. The case may be fastened to the vehicle body in the two manners shown; that is to say, it may be placed either inside the body or below it. The worm has four threads, cut either right-handedly or left-handedly.

Malicet & Blin also exhibit a two-speed change gear for tricycles, and a heavier change gear for vehicles. The latter has four sets of gears, on parallel shafts. The loose gears are engaged with their shafts by means of positive clutches, which are operated by cams, in such a manner, that by means of a single operating lever, one after another of the four different speeds are obtained. The gears are enclosed in an aluminum case.

THE "HELENE" PNEUMATIC TIRE. (Referred to in part vi)

## PATTERN MAKING FOR GASOLINE MOTORS.

PART V.

BY W. O. ANTHONY.

### PATTERN FOR VALVE STEM GUIDES.

This pattern is so simple as to scarcely require description. The pattern is shown in Fig. 48, in which A is the guide for the inlet valve stem, and B the guide for the exhaust valve

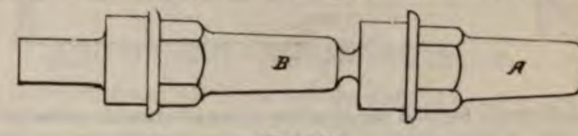



FIG. 48.

stem, this method being that employed by the writer for very small pieces wherever possible. In this way the castings are more uniform and more free from hard places. The connecting parts being small, only a few strokes of the hack-saw are necessary to separate them. This is a split pattern, and the hexagon is to be cut after splitting. Let the parting-line run through the corners of the hexagon, as this will facilitate cutting the faces. It will be noted that the exhaust valve guide is longer than the inlet guide. The exhaust stem is subject to much greater wear, and the spring being upon the outside, this extra length makes no difference to the length of the stem, while giving added surface to take the wear. In the inlet valve, the spring being inside, any extra length of guide would necessitate a longer stem, with a given power of spring.

### PATTERN FOR CASING FOR REDUCTION GEARS.

If a casing is to be employed to protect the reducing gears and cam from dust and rain, it may be cast upon the crank-case and have a separate cover to be bolted on, or the body of this casing and the cover may be cast in one piece, and bolted to the crank-case, the lower edge and the surface of the crank-case being machined to make a tight joint. If the former method is to be pursued, the piece forming the body of the casing may be made a loose piece, as previously mentioned in describing the crank-case. By this means, one pattern will do for both halves. Having determined the depth necessary to contain the gears and cam, the pattern may be sawed from a block of this thickness. As this casing should be as light as possible, a better way, to insure durability, is to make up a block of the right thickness from three layers firmly glued together, the grain running at right angles in adjacent layers. A good form for this casing is shown in Fig. 49. The draft, if

FIG. 49.

cast with the crank-case, should be in two directions, as shown in Fig. 49. The inside should be given a liberal amount of draft. For the sake of lightness, the lugs AA, etc., Fig. 49, may be only ⅜-inch or ½ inch above the surface of the crank-case, and the bolts or cap-screws made long enough to extend into them through corresponding holes in the cover. A thickness for this casing of 3/16-inch or 5/16-inch at the bottom, or thickest part, is sufficient. The cover is to be sawed from ⅛-inch stuff to the same shape and size as the casing itself, leaving a hole to be cored opposite the secondary shaft, so this may pro-

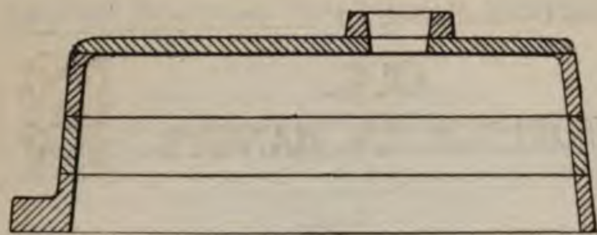


Fig. 50.

ject sufficiently beyond the cover to allow of attaching the ignition cam. A boss, about ⅜-inch high, should project all around this hole, and be concentric with it, for the base carrying the vibrator spring, to partially revolve about in shifting the spark for change of speed. Stock should be left inside this hole, and outside the boss surrounding it, to allow of machining these parts. Should it be desired to make this casing and its cover in one casting, to be bolted to the crank-case, the same general directions should be followed as for the other form, except that draft must be given, both inside and out, in one direction, and the cover glued to the top and its corners well-rounded. Fig. 50 shows this construction, and the direction of draft, also the hole and boss around it, all in section through the center.

PATTERN FOR IGNITION GEAR-CASE.

This pattern may be as thin as can be run in aluminum, this being the metal most suitable for it. A pattern ⅛-inch thick all through is thick enough. It may be made in about the same way as the gear casing shown in Fig. 50. No lugs are required upon this pattern if the form generally employed is adopted. Nor is there any hole to be cored through it, as the two small holes for the studs holding this case in place can preferably be drilled.

The gear and pinion for this motor may be bought from stock, or patterns may be made for them, if a gear cutter is available. For experimental work the former is doubtless the better way.

The patterns would be extremely simple in any case. They should be sawed or turned on the face plate, a trifle thicker than the face of the gears, and enough larger in diameter to allow of machining the blanks to size. The cam to operate the exhaust-valve is best worked out from the solid, in tool or machine steel, and tempered or casehardened. Good results may be obtained, however, by making a pattern for the cam

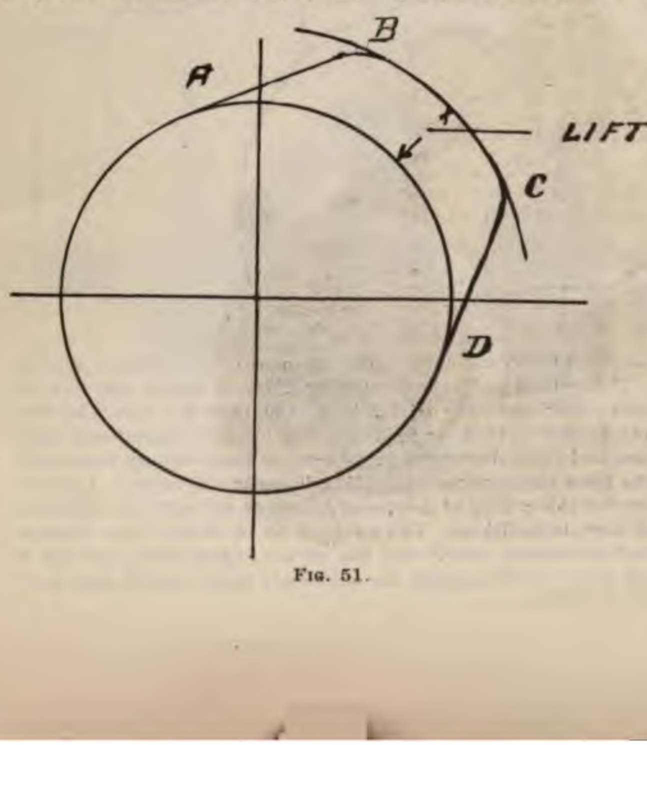



Fig. 51.

integral with the pattern for the gear, and having cast in a grade of steel which may be hardened the same as tool steel. To lay off a cam, having determined its lift, a circle for the idle portion of the cam should be described, then the amount of lift added to this radius, and an arc of about a third of a circle described about the same center. Draw a line through the center, and another at right angles to it, also through the center. Fig. 51 illustrates the idea. The exhaust cam must hold the valve, open for a trifle longer time than that consumed by one-half a revolution of the motor shaft. The exhaust should commence when the piston is ¼-inch to ⅜-inch from the bottom point, upon the impulse stroke, and end at the next top dead center. Therefore, the secondary shaft, and with it the cam, will go through a trifle more than one-quarter of a revolution during the exhausting period. This necessary lead in the exhaust is obtained by drawing the lines A B and C D, Fig. 51, a trifle beyond the straight lines defining the quarter circle. This distance is best found by experiment.

The approach of the cam should be gradual, to avoid the pounding of the roller upon the cam. The greater the time a cam holds the valve wide open, the greater will be this pounding. The valve must not be held wide open more than one-half the exhaust period, and the cam shown in the figure will just about accomplish this. If the cam is to be cast integral with the gear, the pattern may be made as shown in Fig. 52, show-

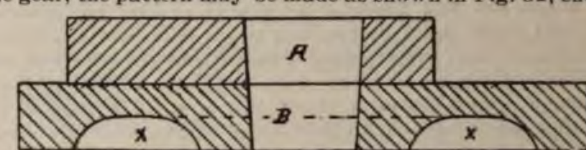



Fig. 52.

ing a longitudinal section through the center, in which A represents the cam, and B the gear. The pattern is made from two blocks, glued together, with the grains at right angles after both have been finished. The semicircular channel, or groove xx, is turned in the under side of the gear, and is simply to save weight.

BRASS PATTERNS.

The patterns described in this article, if carefully made, may be used for many sets of castings, but if castings are to be made regularly in quantities, metal patterns should be made for the lighter pieces, especially for the crank-case. Such patterns are best made from soft brass Generally they may be filed to a sufficiently good surface, but in many places, as, for instance, the inside of the crank-case, and the shaft portions of the crank-shaft, it is a good idea to turn them in the lathe. Generally, the original wooden pattern will do as the pattern for the brass pattern, places to be machined in the latter being built up with pasteboard, glued in place and shellacked. Parts which would be affected by the slight shrinkage in the brass should be either thus built up or, rapped much harder in the mold. This will apply especially to the crank-case pattern. In machining a brass split pattern, the inner surface should be either filed to an approximately flat surface or dressed flat in a shaper, the latter method being preferable. Both inner surfaces must then be thoroughly tinned with a soldering iron. Fasten together with a wire at either end, twisted tightly and set into the soldering stove or into a common cook-stove until the solder melts. Now remove and clamp in a vise, keeping the halves in the correct relative position until cold. The pattern, in this condition, may be filed or machined as a solid piece. Holes for brass dowel-pins should now be drilled, $\frac{3}{16}$-inch diameter, and the pins fitted and held in place by soldering. These pins should project into the lower piece only very slightly, not over ⅛-inch in any case, as, if longer, they are apt to bind in separating. The pattern should be split before the pins are fitted to place. This may be done by inserting the edge of a chisel into the joint at one end, when a few sharp blows will separate the halves. The inner surfaces will tin much more readily if the parts are heated first. Brass being compara-

tively expensive, it is economy to make the inner surfaces in split patterns hollow, wherever possible. This is very readily done in the wooden pattern with a gouge. A $\frac{3}{16}$-inch hole must be drilled in all brass patterns, and tapped $\frac{1}{4}$-inch—20-threads—at the point where the molder inserts the tool for drawing the wooden pattern from the mold. While brass patterns are warm from soldering they should be rubbed over with the wax used upon the wooden patterns. This will fill the little places not reached by filing and make a fine surface. Such patterns will last a lifetime.

## A NARROW ESCAPE.

*The Motor-Car Journal* reports an exciting incident recently experienced at Folkestone by Grahame White while driving his 12 h. p. Daimler from Deal to Folkestone by way of Dover. The steep descent into Dover was negotiated in safety, and when the equally notorious hill into Folkestone was reached it was found that the brakes had fired and had burned away under the prolonged strain. Mr. White sought to check the acceleration of the vehicle by steering it from side to side of the road, but it seemed to surmount any obstacle against which it was driven. Finally he drove the vehicle on to the pavement, between a lamp-post and a wall, which formed an exceedingly narrow passage, and then pulled it straight across the road and steered it through a narrow gate into the yard of Folkestone Junction. Here he slew the car around within an extremely narrow space (at the estimated speed of 30 miles an hour), went back through the gate and turned his vehicle up grade, where it finally stopped. It is stated that all four tires were ripped off simultaneously when the vehicle was wrenched around in the yard, but that the wheels held together despite the tremendous strain.

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Not long ago the French Academy decided that, contrary to usage, the word "automobile" is masculine. It now appears that this decision was reached by seven academicians only. Three voted for feminine, while the rest of the learned assembly happened to be sojourning in the country.

Let us, then, remarks a French contemporary, quietly say "une automobile," at the risk of never becoming academicians.

# ...OUR... FOREIGN EXCHANGES

## THE HENRIOD 25 H. P. VEHICLE.

C. E. Henriod was one of the earliest workers in the automobile industry, having been actively engaged in this line for more than 10 years. Automobiles of M. Henriod's design have been built both in Switzerland and in France, and the French Compagnie Henriod exhibits at the Exposition six different types of vehicles. During the earlier part of this year, M. Henriod constructed a number of 25 h. p. vehicles for his own account, and according to his latest patents, to take part in the Paris-Bordeaux race of May 13, 1900.

The race was prohibited, but M. Henriod, having his vehicle finished, started on a tour to attend the Congress of Swiss *Chauffeurs* at Berne. From Berne he continued his journey to Geneva, and returned by way of Brienne, Zurich, Balé Colmar, Strassburg and Nancy to Paris. In this trip a distance of 2,400 miles was covered. A vehicle of this type is shown in class 30 of the Paris Exposition, where it draws considerable attention on account of the compactness and evident strength of all its parts.

The four-cylinder engine is placed in front, and below the frame, which permits the use of any form of body with the running gear, and also lowers the center of gravity. The cross bars F' F'' M' M'', which support the motor and the speed gear, serve at once as stays for the frame, and prevent all deformation of the latter. The bolts holding together the various parts of the frame are provided with nuts and lock-nuts, and pins are made use of at the joints, thus furnishing a much better frame than if it was assembled with rivets. The frame is carried by semi-elliptic springs, which are fastened to the supports f, e, d, c.

The speed-changing gear is represented by F, and the differential shaft by B. The bearing brackets for the differential

25 H. P. HENRIOD GASOLINE CARRIAGE.

FIG 2

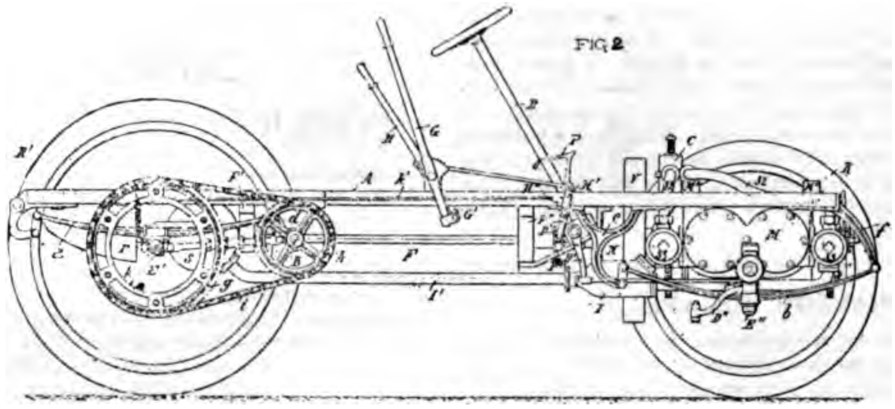


FIG 8

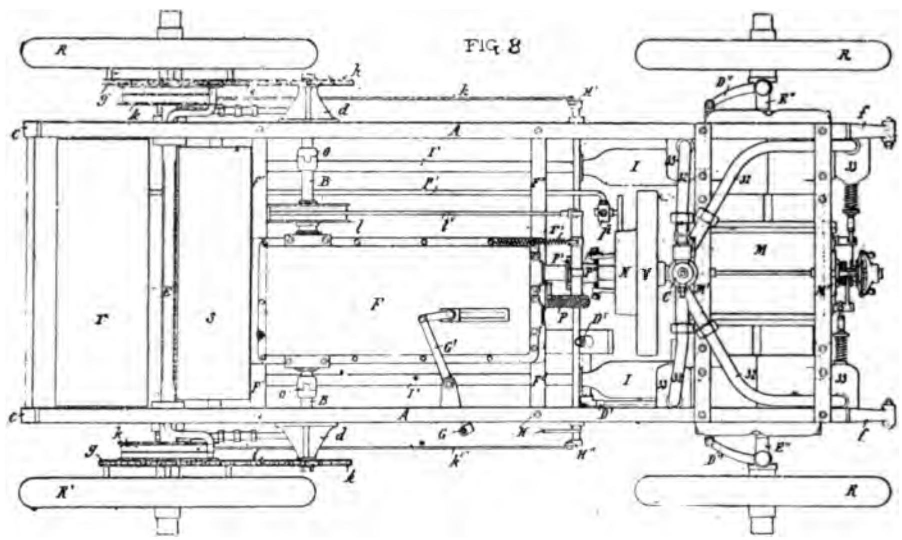
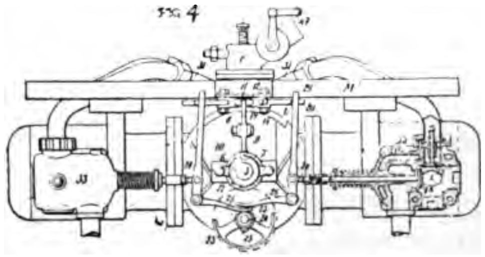


FIG 4



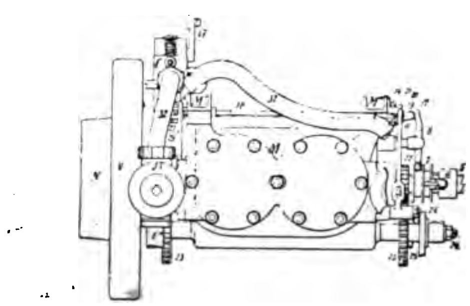


FIG 6

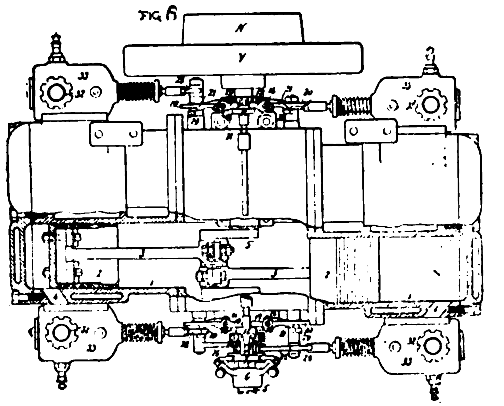
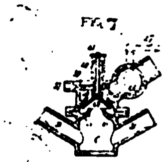
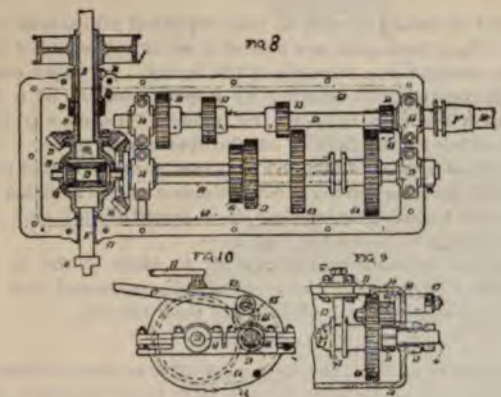


FIG 7



shaft also serve as supports for the springs. The brake on the brake drum 2, on the differential, acts in both directions. G represents the speed-changing lever. V is the flywheel of the engine, which encloses a friction clutch, operated by a foot lever P, connected with a cone P', turning loose only on the motor




shaft. To the ends of the shaft H" are fastened single armed evers, to which are attached the rods from the band brakes acting on the hubs of the wheels. This shaft is operated by a lever H', which latter will also unclutch the engine if it be operated without the pedal P being first depressed. The rod C' acting on the brake on the differential is fastened to a bell crank mounted loosely on the shaft H, which is also operated by the foot lever P. Thus braking and unclutching the engine may be effected either by the lever H' or by the foot lever P. D represents the irreversible steering gear endless screw; I I' the exhaust pipe; S the muffler; R the water tank; p a pump, operated by friction from the flywheel of the engine; f the water pipe, leading from tank to pump.

Fig. 8 is a detail drawing of the speed-changing gears. The shafts 50 and 59, and the bearings 55, 56, 57, 58, 74, 75 are entirely in the lower part of the casing. and the upper part only serves as cover. The gears are thus easily gotten at.

A special feature of this new design is that the two level pinions 76 and 77 always remain in mesh, the reverse motion being obtained by means of a spur pinion 65, which engages the pinion 54 and the gear 64 of the slow speed, when they are out of gear. This arrangement has permitted to do away with the movable stops which shifted the bevel gear to the position of forward or backward motion. Experience has proven, more than once, that this disengagement of bevel gears is defective. The two screws 80 permit to regulate the distance between the pinions 76 and 77. It may be mentioned that with the form of clutch employed there is no lateral effort on the shaft 50 which carries the clutch. The strong spring, which is necessary with conical clutches, is thus suppressed, and with it the heating which it produces at the thrust collars of the shaft.

Fig. 10 shows an end view of the speed gearing, as seen from the clutch end, from which it will be noticed that the reverse motion is obtained by lever 67, which makes the pinion 65 rotate around an eccentric pivot.

Fig. 9 gives a longitudinal elevation, in which is seen the fork operating the gear carriage. The conductor controls this fork by means of the lever 62.

## INTERNATIONAL AUTOMOBILE CONGRESS.

The following is an abstract from the report on the details of construction of vehicle frames and their parts made by A. Bollée, sen. to the third section of the Congress.

The re ort touches on three principal subjects:

1.—Piping and pipe joints.

2.—Loosening of nuts.

3.—The use of aluminum and its alloys.

In each of these three subjects it is hard, if not impossible, to draw from the results of the numerous experiments already made precise rules such as may be formulated for the dimensions of the parts of steam and gasoline engines.

The piping of automobiles is made in the most varied manner, for the reason that it must conform to the mechanical requirements as well as to the carriage work, which latter is constantly getting more luxurious.

It is rare that the designer troubles himself with the piping in laying out his vehicle; it is only after the vehicle is finished, or nearly finished, that he thinks of this important part, which can then only be solved by giving the pipes a winding, or bent form, in many cases giving to an automobile outfit, simple in itself, a very complicated appearance, which frightens the beginner.

I am persuaded that an automobile must not only be simple but must also have an appearance of simplicity.

For this reason the simplification of the piping is becoming of more and more importance with many builders. Some manufacturers have brought together as much as possible the parts to be connected by pipes, which formerly extended the full length of the vehicle, and in some cases many of the pipe connections have been done away with altogether.

Unfortunately, it is impossible to do away with the piping altogether, and it is, therefore, in order to study means for preventing the breaking of pipes, and thus doing away with a very common cause of stops.

The most general causes of breaking are:

1.—Vibration of the pipes.

2.—The deformations they have to undergo, either through stretching, or through the relative displacement of the parts which they connect.

With rubber-tired wheels there is, of course, much less vibration than with ordinary wheels. In vehicles with a good spring suspension, and where the pipes are not too long, this cause of breaking may be considered negligible. For vehicles which are not well suspended the only remedy is to fasten the pipes, in a number of places, to rigid points, and in surrounding them with a connection piece, lined with some yielding material, as, for instance, leather.

As to the deformations of the pipes, resulting from a change of the relative positions of the pieces connected, there is no other remedy than to make the pipes of such a form and length as to give them sufficient elasticity to compensate for this change of position.

In many cases there is no other solution to the problem than to interpose, either at one or both ends, a piece of flexible tubing (rubber or flexible metal tubing), or to provide a joint similar to the gaskets of steam engines. In a number of pipe connections there is no need of tight joints, as, for instance, in exhaust pipes, or in the pipes carrying air to the carbureter. The exhaust pipes should be allowed to expand freely, as they are subjected to great differences of temperature. This is sometimes accomplished by mounting the muffler loosely on its support.

The nature of the metal is of great importance. For water and gasoline piping copper and its alloys, and, in certain cases, aluminum, give satisfactory results; but for very high temperatures—for exhaust piping, for instance—it is absolutely necessary to use iron or steel pipes.

To conclude this question of piping, we will consider the different forms of joints. For small pipes, for the gasoline, or for the water circulation, the simple conical union, in which two ground surfaces are joined by a nut, appears to be the most satisfactory. Often it is sufficient to use flat surfaces, not ground, between which a yielding washer is pressed, by means of a nut. Sometimes one of the two flat or conical surfaces form a collar or cone, obtained by suitably shaping the end of the pipe. Where braced joints are used the jointed parts should well overlap each other, to prevent loosening.

There is a marked tendency in the automobile industry to discard all joints made with red lead, leather, felt and asbestos in favor of a joint consisting of an exterior envelope of thin sheet copper, enclosing either asbestos or a malleable material which makes a tight fit with the faces of the joint, under the

pressure to which it is subjected. In vehicles *de luxe* makers try to use this joint or ground joints exclusively. For water piping, fibre joints have, however, their staunch partisans.

LOOSENING OF NUTS.

The greatest care must be taken to prevent the loosening of nuts in automobiles. A screw lost in the steering or braking apparatus may lead to very serious accidents. A screw dropping out may also cause the breakage of some of the principal parts, as, for instance, the gears, if it should drop into them while the machine is in motion. One must do everything, therefore, to prevent the nuts from loosening and from dropping off. Intentionally separate the two phrases, the loosening and the dropping off of nuts, as their causes and remedies are very different.

If the nut of a bolt or a stud loosens after having been drawn down tightly, and without being caused to turn by an angular movement of the pieces connected by it, the cause must be attributed to a too great strain on the bolt and the nut, which results in elongating the bolt beyond its elastic limit, in crushing the support for the bolt head nd nut, or in spoiling the thread of the nut. In any case, the first loosening is produced, and the vibration will do the rest.

One must, therefore, try, above all, to prevent the first loosening; in other words, make sure that the elastic limit of the material of the bolt, nut and joined pieces are not surpassed. This consideration also leads us to the use of washers of a hard metal, having a diameter considerably larger than the nuts, under the heads of the bolts and under the nuts, when the pieces joined are made of a relatively soft material, as, for instance aluminum.

There are cases, however, in automobile work, where bolts will be taxed beyond their elastic limits, and to prevent the nuts from coming loose in such cases elastic washers are employed. These washers compensate, by their elasticity, for the elongation of the bolt. The elastic washers usually employed are portions of a left handed coiled spring (for holding right hand threaded nuts). The two ends of the spring have a sharp angled corner, which digs into the surfaces with which the washer is in contact, and effectively prevents the turning of the nut. When loosening the nut with a wrench it is often necessary to break the washer.

In certain cases, instead of elastic metallic washers, pieces of leather, rubber or wood are used with success. Wood is very generally used under the springs of vehicles.

From the preceding we conclude that all the supports should be made normal, and that, as a consequence, the heads and nuts should be perpendicular to the centerline of the bolt.

In general, in automobile vehicles, bolts which are subjected to shear loosen much easier than those subjected to tension. This is due to the fact that the least displacement of the piece with regard to the nut may tend to produce an angular movement, either of the bolt or of the nut. If this displacement continues there is wear, which will cause the loosening of the nut.

One should, therefore, try to avoid bolts working under shear, and where this cannot be done, use bolts of liberal size, and in sufficient numbers, to preclude the possibility of an angular displacement of the piece with regard to the bolts. Besides this, it is of importance that the inner surface of the bolt head and of the nut be perfectly flat, which increases the surface of support, and the radius through which the friction acts.

In order to draw a nut up tight, the threaded part of the bolt and the inner face of the nut must be well oiled. It is also well to lightly strike the head of the bolt with a hammer while drawing up the nut.

Having reviewed the causes of the first loosening of nuts, it remains to indicate means for preventing them from dropping off the bolt in cases where, in spite of the precautions taken, loosening occurs.

The most common means consists in putting a pin through the end of the bolt. Care should be used to make the pin fit the hole, and to bend the ends so that repeated vibrations will not cut it. Often these pins are placed in slots in the end of the nut, so as to prevent any turning of the latter. In other cases the nut is prevented from turning by imprisoning it in a slotted plate, which is held in place by others lots, or any suitable means, either on the bolt or on the stationary piece.

The use of lock nuts is also a very common method of preventing nuts from unscrewing. Sometimes a washer with a projection on the inner circle, sliding in a longitudinal slot on the bolt, is placed between the two nuts.

Split nuts, forming springs, either in their plane or in the direction of their length, have also been proposed, but I have not had an opportunity to judge of their results.

ALUMINUM.

What I have said on the loosening of nuts due to crushing of the supporting material, restricts, in a large measure, the use of aluminum, this being a material with little resistance to crushing. Its high price is another obstacle to its more general adoption, but its lightness and easy working qualities often compensate for the higher cost, and create a great demand for it.

Aluminum may generally be employed where cast iron would be suitable, and where it is not subjected to friction and to high temperatures. Its resistance to compression is considerably less than that of cast iron, and parts subjected to repeated strains should be made of liberal size.

Screw threads hold very well in aluminum if they are not too fine, and if the screws do not have to be removed too often. Aluminum is commonly used for casings of the engines and the gearing, for pulleys, which have a great adhesion, and for parts which are not subjected to any particular stresses, such as carbureters, oil cups, certain pipes, and the vehicle body. In such cases aluminum generally gives satisfaction if the models are well designed, and if the metal is not subjected to high temperatures.

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## CAPEL'S MOTOR CAR

This motor vehicle contains many features of novelty, both in construction and design, says *The Automotor*, and has been built under the patents of the late Mr. H. C. Capel. Among the many objects which have been aimed at in this machine, the following may be particlarly mentioned:—(1) Incorporating as many of the parts, essential for the propelling mechanism, into the frame itself as is usefully possible. (2) Suspending the body and framework upon the axles in such a manner as to be rigid laterally and flexible vertically, while at the same time permitting the road wheels to conform to any irregularities of road surface. (3) Rendering the motor as automatic in its action as possible. (4) Condensing the variable speed transmission gearing into a small space, and arranging it in such a manner that each gear can be applied gradually. (5) Providing a sensitive steering gear in which the wheels are unable to act back upon the steering lever. (6) Fitting the seats and the body of the car in such a manner that the whole of the mechanism is normally enclosed, but that it can be readily and completely exposed to view when necessary.

The car is clearly shown in the drawings, which we herewith reproduce, and its general appearance is well seen in Fig. 1. It weighs about nine cwt., is under complete and easy control, and travels smoothly even over rough and uneven roads.

The framework (Figs. 2 and 3) is composed of an aluminum petrol tank, A, and a similar water tank, $A_1$, which are connected together by the carbureter, B, and the cross-piece $F_2$. The tanks are connected rigidly with the tubular framing, D, which carries the third seat, and which forms the front portion of the car; they also are attached to the springs, O, O and C, $C_1$, which carry the back and front axles respectively. The springs, $C_2$, also connect the front axle to the frame.

The two principal seats, together with their footboards, are fixed separately to tubular frames, $E_1$. These frames are hinged to the main body of the car at E, and are consequently

FIG 1.—THE CAPEL STEAM CARRIAGE

capable of being swung forward, as shown by the dotted lines in Fig. 2, or of resting in their normal positions upon a bar carried upon the flat springs, $E_2$, on the tanks, A, $A_1$. By placing these seats in their forward positions, and by removing a cover at the rear of the car, the whole of the propelling mechanism can be readily got at when desired.

The motor, F, is fixed horizontally, as shown in Figs. 2 and 3. $F_1$ is the valve chamber. It has two water-jacketed clylinders, 3-inch bore by 5-inch stroke, and develops 4 b. h. p. at 800 revolutions per minute. This motor is more clearly shown in Figs. 4, 5 and 6, in which the general construction is evident. The two connecting rods work upon crank pins, $B_3$, which are in line with one another, and between which is fixed a worm wheel, C. This wheel drives the cam-shaft, E, at half the speed of the crank-shaft, B, by means of the worm wheel, D. The crank chamber is fitted with a cover, $A_1$, which enables the bearings to be taken up when necessary, and this cover is itself provided with an inspection cover, $A_6$. The cam shaft, E, is hollow, and the governing rod, G, G, passes through and slides within it. The governor is fitted to this shaft, as shown; its duties are threefold: (*a*) to act upon the throttle valve and regulate the admission of mixture to the cylinders; (*b*) to actuate the contact maker, which causes ignition in the cylinders, in such a manner as to vary the time of ignition to suit the speed of the engine, and (*c*) to slide the exhaust cams along their shaft in such a manner that half compression only is

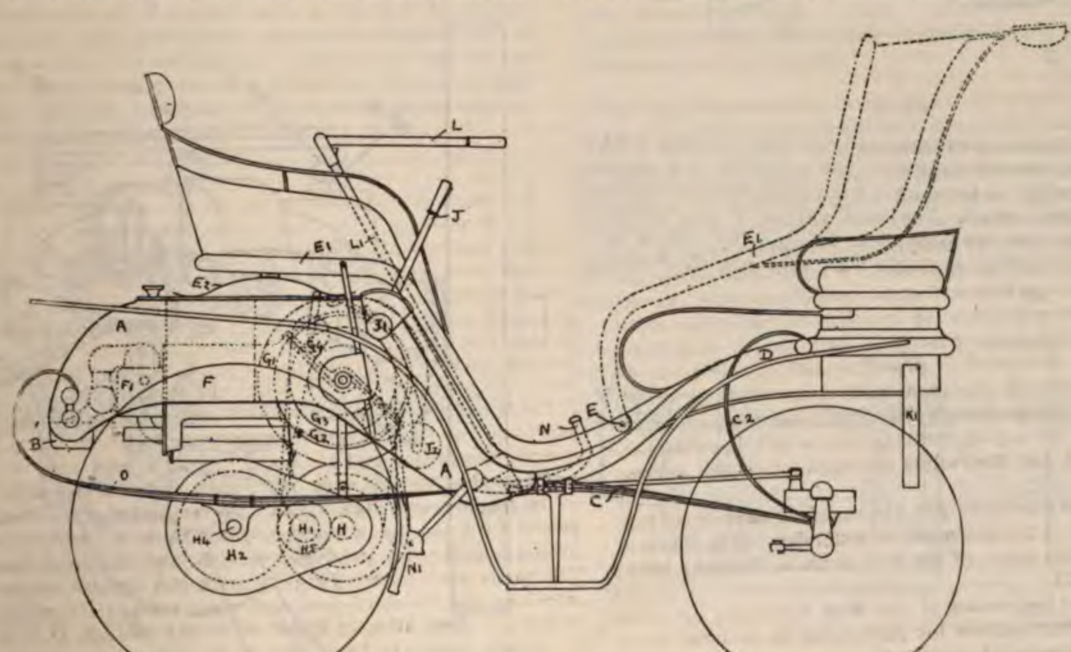


FIG 2.—ELEVATION OF CAPEL CARRIAGE.

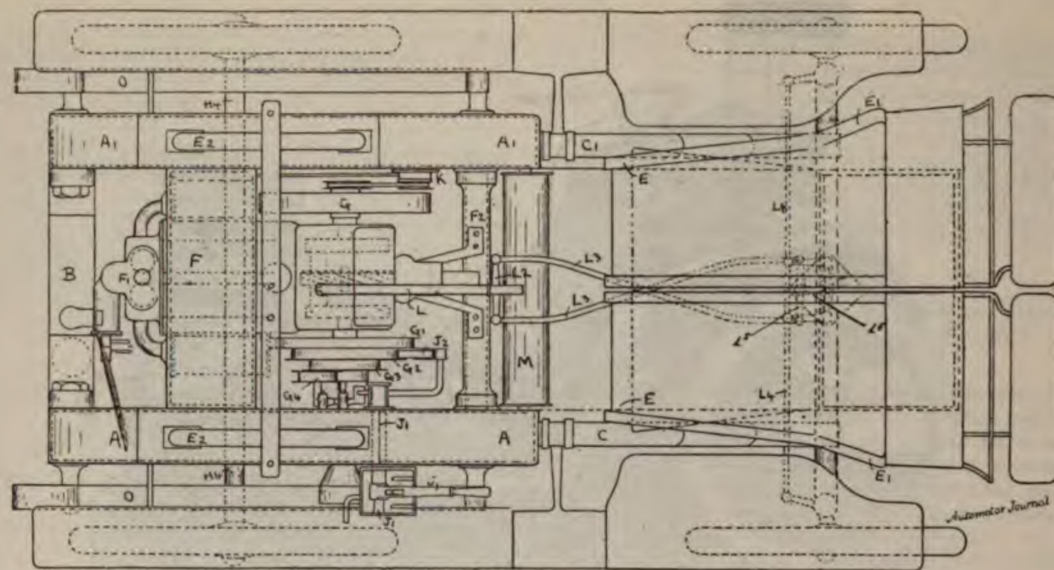


FIG. 3.—PLAN OF CAPEL CARRIAGE.

attained in the cylinders, for starting the motor by hand, below a certain speed. The governing rod, G, is fitted with a spring

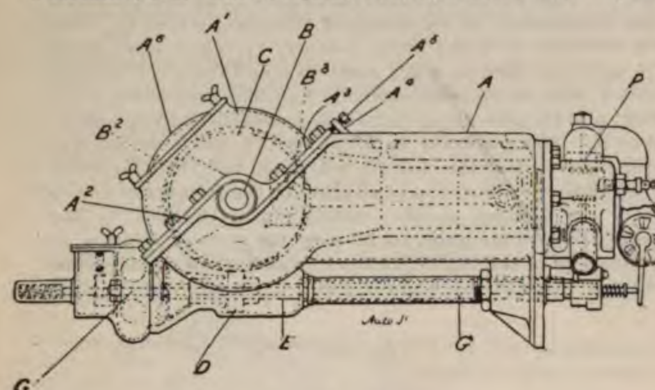


FIG. 4.

at either end; that at the right-hand end (Fig. 4) being weaker than the spring at the other end; the governor acts against the stronger spring. A hand lever enables the driver to regulate the normal engine speed. The inlet valves, P, are actuated atmospherically, and are both held in place by means of a cover, which is fixed by a single nut; they are thus readily

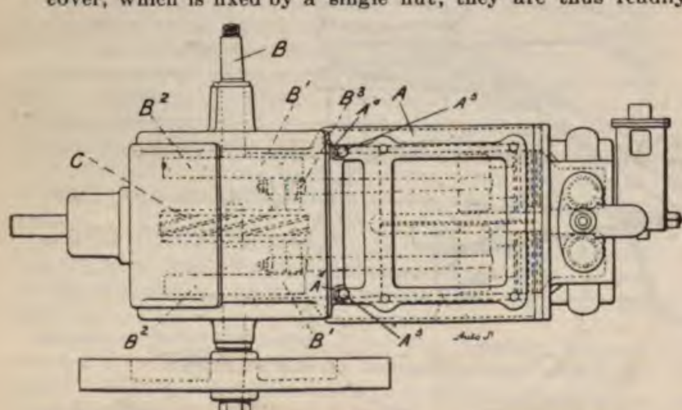


FIG. 5.

removable. The exhaust-valves, K, are placed immediately below and opposite to the valves; they can be examined when the inlet valves are lifted out. The exhaust-valves are operated positive by means of the cams, $H_2$, and the rocking lever, L, as seen in Fig. 6.

The motor shaft carries four leather-covered pulleys of different sizes, $G_1$, $G_2$, $G_3$, and $G_5$, the first three of these are connected by slack chains with three different sized pulleys upon the counter-shaft, H. Either of these three chains can be caused to tighten and to transmit power from the motor to the shaft, H, by means of the jockey pulley, $J_2$. This jockey pulley is carried upon a rocking lever, $J_1$, and can be caused to tighten whichever chain it is placed against by means of the hand lever J. The lever, $J_1$, is capable of sliding longitudinally, and can consequently be made to tighten either of the three chains. The

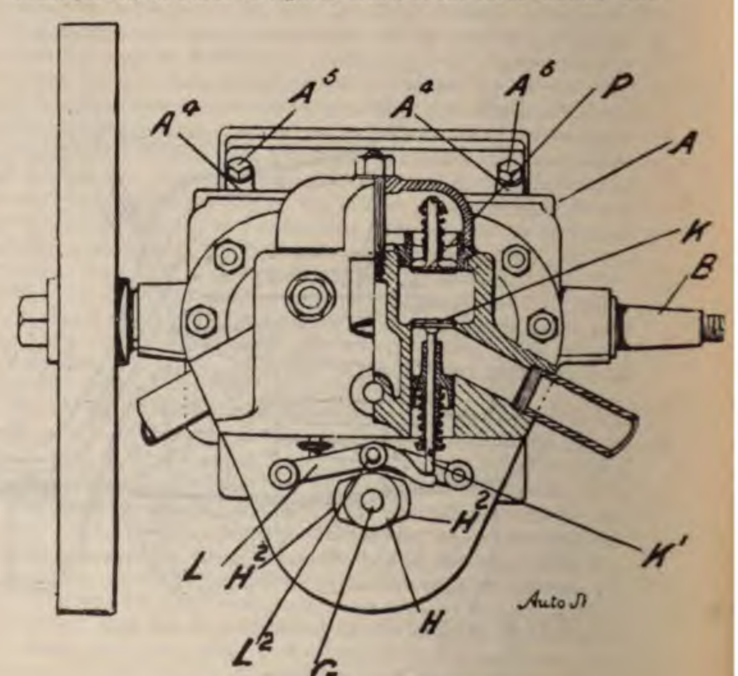


FIG. 6.—END VIEW OF MOTOR.

lever, J, is fitted with a detaining catch, $J_6$, which locks it in either forward driving position.

The counter-shaft, H, is fitted with a pair of gear wheels which drive the planet wheels, $H_6$, of the differential gear, on the rear "live" axle, $H_4$, by means of the intermediate gear wheels, $H_5$, $H_1$, and $H_2$. The whole of this gearing is enclosed in a dust-tight case. The distance between the motor shaft and the counter-shaft, H, can be adjusted by means of a swinging link, and the relative motion of the back axle and of the motor shaft is compensated for by means of this construction.

The motor shaft is fitted with the flywheel, G (Fig. 3), and with a chain wheel, which drives the rotary pump, K. This pump circulates the cooling water through the radiator (Clarkson's), $K_1$, in the front of the vehicle.

The steering gear is shown in Figs. 3, 4 and 9, and is particularly ingenious. The hand lever, L, is so placed that the driver's left arm rests upon it; it is so arranged that it points in whichever direction the vehicle will move. The lever, L, is connected to a rocking lever $L_2$, by means of the rod, $L_1$. Two crossed connecting rods, $L_3$, connect the ends of the lever, $L_2$, with the ends of the lever, $L_5$, and consequently cause the arm, $L_6$, to move to right or to left, according to the movements of the hand lever, L. The arm, $L_6$, is fitted at its outer end with a pin, and this pin engages with either of two forks. These forks connect to the steering wheels by a link and lever connection which complete the detail of the mechanism.

The gear ratios which are provided are calculated for 4½, 12 and 12 miles an hour. The capacity of the water system is six gallons, and that of the gasoline tank is five gallons.

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The Shah of Persia is now numbered among the staunch adherers of the new locomotion. After having bought a number of automobiles at Paris he continued his purchases at Ostende, where he had his secretary of the treasury take a ride in the steam voiturette of Mme. Groen, conducted by the fair proprietress, and afterwards ordered a landau and a three-passenger vehicle—both steam machines.

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In a recent automobile accident, between Chateaudun and Vendome, France, the vehicle turned over on a hillside and a number of the occupants were severely injured. Quite a large crowd congregated at the scene, and a military physician, stationed at Vendome, placed his vehicle at the disposition of the automobilists. The demolished automobile had to be transported to the railway depot at Freteval, two and one-half miles away. For this transport, made with a farm wagon, a farmer asked the modest sum of 180 francs ($38).

# ...COMMUNICATIONS...

## CARBURETER AND COMPRESSIVE DIMENSIONS.

A. H. KELLEY.

HUNTINGTON, IND.

[Replying to your inquiry of the 5th inst., would say that one inch would be a suitable internal diameter of both constant level and vaporizing compartment of your carbureter.

The proper compression space for a cylinder of 1⅞ inch bore and 2¼ inch stroke is ¾ inches.—ED.].

## LITTLE ATTENTIONS WELL REPAID.

NEW YORK, Sept. 6th.

*Editor* HORSELESS AGE:

I make a practice of taking off the burner about every two weeks and giving it a thorough cleaning and a coat of stove blacking inside and out, just as you would any other stove. Pull out the brass mixing tube and shake out of the mixing chamber the flaky dust that accumulates therein. Do not, in doing this, pound or bang the burner about, as this tends to loosen the tubes. Now replace the mixing tube, cut side down, and, by the-by, if you are troubled with a "popping" burner, increasing the length of the cut section about an inch, with a hack saw, will insure better mixing and stop the trouble, if there are no loose tubes. Apply with a blacking dauber a thin coat of liquid or paste stove blacking, being careful not to clog any of the small holes. Rub the blacking well into the surface of the plate, and you will prevent the oxidizing of plate and tubes to a surprising extent. "Enameline" or any carbonate of iron blacking will answer.

The steam carriage is an appreciative machine, and you will be well repaid for such little attentions as this by many miles of delightful riding and steam to "burn." L. H. E.

## WANTS THE DISTINCTION DRAWN.

SAN DIEGO, CAL., Aug. 30th.

*Editor* HORSELESS AGE:

The enclosed clipping is a fair sample of the press accounts of an automobile accident, of which, I think, I have seen at least a dozen, and in every instance it was stated or implied that the vehicle was a "gasoline carriage" when, to the understanding reader, it is plain that steam was the motive power.

This undoubtedly creates a wrong impression in the public mind in regard to the bona fide gasoline wagon, and seems to me very unfair to that power.

I thought this might be of interest in connection with the recent discussion on the safety of steam boilers on light road wagons.

I never have seen an authenticated account of a similar accident to a gasoline carriage, except where hot tubes were in use for ignition. Very truly yours,

R. H. GUNNIS.

## HOW LARGE CYLINDERS MAY BE AIR COOLED?

CHICAGO, Aug. 29, 1900.

*Editor* HORSELESS AGE:

Kindly inform me how large cylinders may be air cooled when cylinders are of best design.

SUBSCRIBER.

This depends, of course, on the speed at which the engine is to run and on the opportunities for ventilation afforded by the location of the engine. The largest air cooled engine made by the DeDion & Bouton Co. has a bore and stroke somewhat less than 3-in., while the bore and the stroke of the Gaillardet air cooled moter are 3¼-in. each. These engines must be disposed on the vehicles or tricycles so that they are fanned by the air currents, or otherwise a rotary fan has to be provided to keep them cool. The use of such rotary fans has led some builders to produce air cooled engines of even larger cylinder dimensions, but 3-in. by 3-in. may be looked upon as the practical limit in the present state of the art.

# MINOR MENTION

J. E. Paul, Eureka, Cal., has completed a gasoline carriage for Dr. Mohawk, same city.

The Standard Auto-Vehicle Co. filed articles of incorporation in New Jersey last week, with a capital stock of $250,000.

A. G. Powell, 204 N. Broad street, Philadelphia, Pa., has made a contract to handle the Keystone Motor Co.'s machines.

M. W. Jamieson, formerly connected with Struthers, Wells & Co., Warren, Pa., is reported about to start an automobile factory there.

The Felker Cycle Co., Denver, Col., agents for the locomobile, write that they have sold two carloads of wagons and have a third on the way.

The Arthur Co., 198 Front street, New York, are selling quite a number of their tube expanders for steam vehicle boilers, illustrated in their advertisement.

The American Bicycle Co. will devote its Toledo or Lozier plant exclusively to the manufacture of steam carriages. No more bicycles will be turned out there, it is said.

One of the electric autocarettes in Washington, D. C., caught fire from a short circuit last week and necessitated the use of a lawn hose before the fire could be extinguished.

The Equitable Autotruck & Power Co., 87 Charles street, Lynn, Mass., claim to have a thoroughly practical burner for kerosene oil, which they propose to use on wagons.

Captain Andrew Pizzini, manager of the Old Dominion Auto-Vehicle Co., Richmond, Va., is said to be taking steps to introduce steam vehicles in that city for public purposes.

The Desberon Motor Car Co., 12 East 42d street, N. Y., expect to have a four ton steam truck in regular service in New York some time in October. They already have orders for six of them. Later they will put out an eight ton truck and a two-passenger voiturette.

The Capital City Automobile Co. has been incorporated at Washington, D. C., with $100,000 capital. The incorporators are: C. F. Norment, E. B. Evans, E. Reynolds, E. L. Wilson, M. A. Ballinger, all of Washington, D. C.; M. A. Ballinger, attorney, Washington, D. C.

The Gloucester (N. J.) County Board of Agriculture recently discussed the automobile with reference to their needs, and decided that it was too expensive and too difficult to operate. Several present took the side of the new motive power and favored its adoption for the transport of produce.

E. C. Stearns, vice-president of the Anglo-American Rapid Vehicle Co., has secured all the American rights of the said company, and will manufacture under their patents. He has secured the Frontenac and Barnes plants in Syracuse, and organized The Stearns Automobile Co. with $1,000,000 capital.

The Friedman Automobile Co., of Chicago, have brought two of their gasoline machines to New York for exhibition purposes. These machines, a tricycle and a voiturette, can be seen at the Automobile Storage & Repair Co.'s rooms, 57 West 66th street. The company expect to open a branch office here soon.

The City Council of Rochester, N. Y., is considering two ordinances which are of vital interest to the automobile industry—one regulating the speed of automobiles in the city and the other in reference to the storage of gasoline and other combustibles. The newly organized Rochester Automobile Club is to have a hearing before action is taken by the Council.

The Dayton (O.) city council is wrestling with the automobile problem, and an ordinance regulating the speed of such vehicles to eight miles an hour has been introduced. The ordinance also provides that these vehicles shall be equipped with lamps and bells, and requires the operator to stop his vehicle as soon as he discovers that a horse is frightened by it.

The Technical Committee of the Automobile Club have secured from the Exhibition Committee the use of the track at the coming show in Madison Square Garden for half an hour each afternoon and evening, during which they will hold contests and exhibitions in starting, stopping and maneuvering vehicles. No prizes of any kind will be given by the club at this show.

J. Ravel, in an article on "Motors at the Universal Exposition," appearing in *La France Automobile*, calls attention, in a roundabout way, to the unsatisfactory attendance at the annex to the Exposition at Vincennes, where part of the automobile and motor exhibits are located, while the more accessible Champ de Mars, where the other part of the exhibit is located, is crowded.

Homan & Schulz are having erected a two-story and basement building at 2642 Broadway, New York, for the sale, storage and repair of automobiles. The building is being put up especially for the purpose, and will contain vaults for gasoline, electrical appliances for charging batteries, complete machine shop, salesroom, lockers, ladies' room, etc. The storage room will have a capacity for 75 carriages. The building will be open for business on October 1st.

At the first automobile race held in St. Louis, Mo., last month, the winner was a gasoline trap fitted with double cylinder 8 h. p. motor, and manufactured by the St. Louis Motor Carriage Co. There were six other entries, one steam, four electrics, and an imported quadricycle. The course was a mile and a half and the prize a silver cup. All the vehicles were regular road machines, but the electrics were loaded up with extra batteries.

The electric autocarettes have commenced running in Washington, D. C. The route begins at Connecticut avenue and S street, extends along S to Seventeenth, to Q street, to Sixteenth, to I, to Vermont avenue, to Pennsylvania avenue, and to the corner of Pennsylvania avenue and Fifteenth street, where a free transfer is given to the Pennsylvania avenue cars. The autocarettes then return over the same route. The company sells six tickets for 25 cents, and these are accepted by all the car lines in the city. The new vehicles are roomy and are capable of a speed of 12 miles per hour.

## CHICAGO WARNS WOMEN AUTOMOBILISTS.

City Engineer Ericson, of Chicago, Ill., who is a member of the examining board for automobiles, declares that he has heard of so many cases of women operators without licenses that he intends to ask the authorities to order his officers to arrest all the women automobilists who have not the necessary badge. Many of the leading society women are said to be included in the number who have not passed the requisite examination. Acting City Electrician Blaisdell says that so far only eight women have secured permits to operate electric vehicles, but his inspectors have discovered that there are twenty-five to fifty women regularly running the machines through the city.

Notices will be sent to all the companies selling automobiles telling them of the projected action, as many of the women operators are in the employ of the companies.

## AQUIDNECK PARK RACES.

The races at Aquidneck Park, near Newport, R. I., on Thursday of last week were a decided social success. The shortness of the track—one-half mile—prevented fast time, and some of the events lacked interest because of the failure of entries to appear or owing to breakdowns on the track.

Twelve races, followed by a final championship race open to all powers, were on the program. The latter was the event around which the chief interest centered, as it was reported that De Wolfe Bishop, Jr., had come prepared to lower W. K. Vanderbilt, Jr.'s racing colors. This Mr. Bishop failed to accomplish, however, the race being easily won by Mr. Vanderbilt.

The following is a summary of the races:

Race 1.—Electric vehicles—Mrs. Hermann Oelrichs won by default.

Race 2. — Tricycles—Kenneth A. Skinner, 10m. 30½s.; J. Boiselote, 11m. 40s.; Harold S. Vanderbilt, not timed.

Race 3.—Electric vehicles, second heat—A. L. Riker, 10m. 44s.: S. C. Crane, 10m. 52½s.; L. H. De Forest, out after half mile.

Race 4.—Steam vehicles—S. T. Davis, 10m. 45½s.; John Jacob Astor, did not finish.

Race 5.—Tricycles, second heat—Charles H. Henshaw, 6m. 52s.; Royal Phelps Carroll did not finish.

Race 6.—Steam vehicles, second heat—J. H. McDuffie, 10m. 56s.; George I. Scott, 14m. 16s.; T. Griffin did not finish.

Race 7.—Gasoline vehicles—W. K. Vanderbilt, Jr., 8m. 58½s.; Alexander Fisher, 13m. 23½s.; James Lanier did not finish.

Race 8.—Electric vehicles, finals—A. L. Riker, 13m. 5s.; Mrs. Oelrichs did not finish.

Race 9.—Gasoline vehicles, second heat—De Wolfe Bishop won by default.

Race 10.—Steam vehicles, finals—McDuffie, 10m. 52s.; S. T. Davis broke down at start.

Race 11.—Gasoline vehicles, final—W. K. Vanderbilt, Jr., 8m. 53½s.; D. W. Bishop, 9m. 30s.

Race 12.—Tricycles, final—Skinner, 9m. 12s.; Henshaw did not finish.

Final Championship Race.—W. K. Vanderbilt, Jr., gasoline, 8m. 54s.; A. L. Riker, electric, 10m. 28½s.; K. A. Skinner, tricycle, 9m. 22s.; McDuffie, steam, did not finish.



# MOTOR VEHICLE PATENTS ∴ ∴ OF THE WORLD ∴ ∴

## UNITED STATES PATENTS.

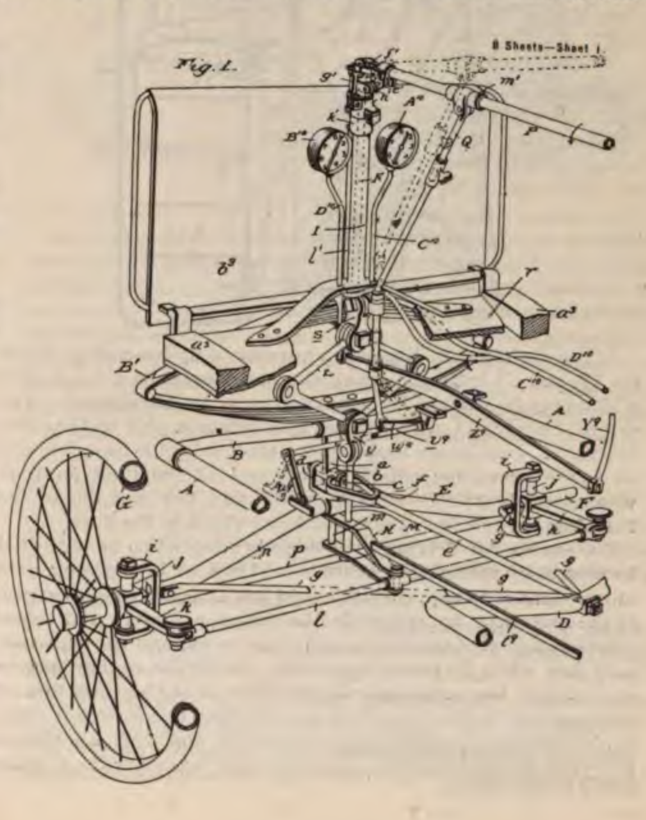
656,715—Automobile Ditching and Grading Machine.—Morton G. Bunnel, of Chicago, Ills., August 28, 1900. Application filed June 20, 1900.

The patent describes a steam excavator, comprising a horizontal boiler, mounted upon steering and driving wheels, a plow at one side of the boiler and suspended from adjusting mechanism, a transversely disposed belt conveyer to receive the soil from the plow, adjusting devices, mounted on the boiler and connected to the conveyer, and an engine mounted upon the boiler, and having power transmitting connection with the traction wheels.

656,962—Motor Vehicle.—Charles D. P. Gibson, of Jersey City, N. J., August 28, 1900. Application filed February 8, 1897.

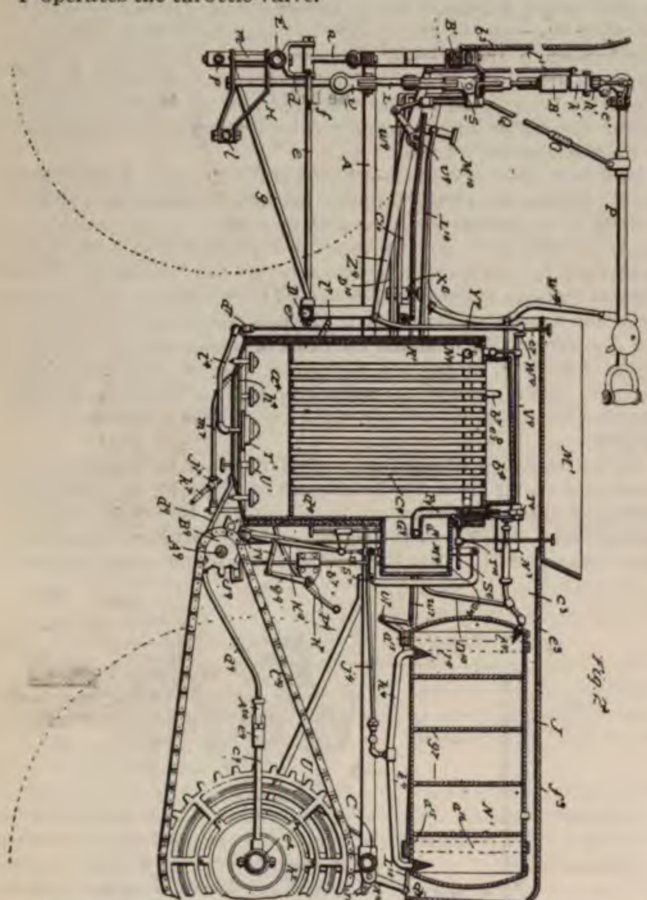
This is a general or combination patent of the vehicle, of which details, such as the valve gear, valves, etc., have been described in the preceding patents to this inventor. The special features claimed and described in this patent are a combination operating lever with three distinct motions, means for discharging the heat and particles of combustion in a downward direction, means for regulating the fuel supply to the burners, and a method of using, in combination with steam, another motor fluid—carbonic acid gas—in the cylinders of the engine.

In the drawings I indicates a tubular post fixedly connected with and rising from the footboard of the vehicle. Through this post extends a rock shaft K, which has its lower end connected with a link s to the upper ends of the upper members of a "diamond" L. This diamond consists of four bars, pivoted



together at their ends. The object of this diamond is to provide for the compression of the body supporting spring, and prevent the shocks, due to the unevenness of the road, being transmitted to the steering lever.

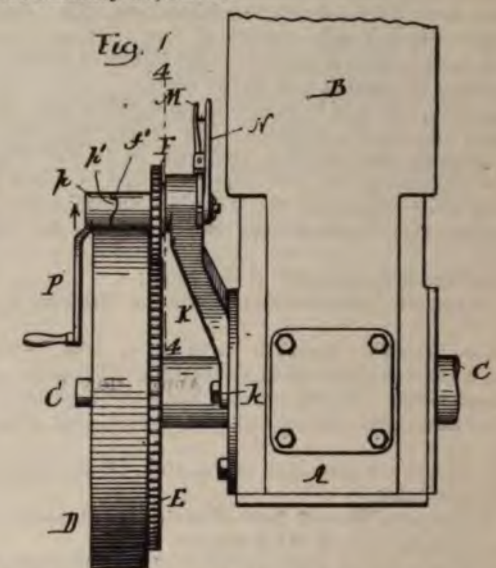
The steering lever P is also capable of a vertical motion, and thereby acts, through the intermediary of the rod Q, lever arm $w^9$, shaft $v^9$, lever arm $u^9$ and rod $t^9$, upon the reversing gear of the engine. Lever P is provided, at its forward end, with an arm $f^1$, which is connected by a link $g^1$ with a sleeve section $h^1$, which is loosely mounted on the post I, and is provided with the circumferential ribs $i^1$, designed to rest and move in the grooves $j^1$ at the upper end of the sleeve-section $K^1$, which latter is in connection with the throttle-valve of the motor. It will thus be seen that a rotary or rocking motion of the lever P operates the throttle-valve.



In the firebox are disposed a number of hydro-carbon burners $T^1$, and $U^1$ indicates what the inventor calls a torch, but which may be similar in construction to the burners $T^1$. The several burners $T^1$ are connected by a common pipe to the gasoline tank. Just before reaching the tank this pipe branches out into two arms, one entering each end of the tank, so that when ascending or descending a hill, and the gasoline in the tank has become low, there will be no check in the flow.

The engine for driving the vehicle is adapted to be actuated by steam, by steam and carbonic acid gas, or by carbonic acid alone—that is to say, carbonic-acid gas and just enough steam in the generator to maintain the piston cylinders and valve-chests in a heated condition, and so as to expand the carbonic-acid gas when it enters the same. While the engine may be actuated by the carbonic-acid gas alone, it is the intention of the inventor to use the gas as an auxiliary to the steam only, as, for instance, in climbing sharp grades, and when additional power is required to drive the engine and maintain the normal speed of the vehicle.

657,055—Starting Mechanism for Explosive Engines.—Carl H. Blomstrom, of Marquette, Mich., August 28, 1900. Application filed January 27, 1900.

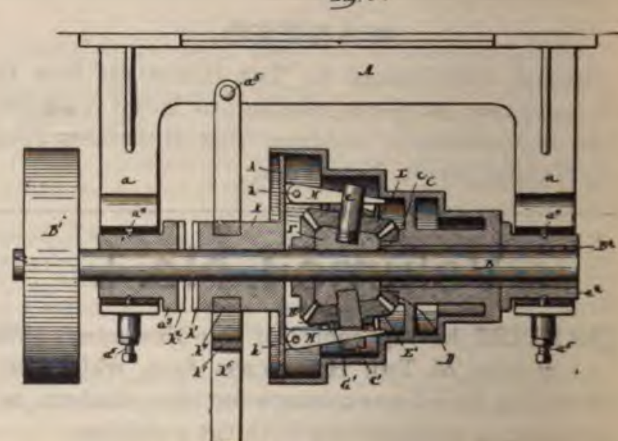


The flywheel D of the engine is provided with a gear E, with which engages a pinion F. The shaft of this pinion is mounted in an eccentric bearing in the bracket or support K. The handle N, provided with the clutch lever M, controls this eccentric, by means of which the gear and pinion may be thrown in and out of gear. The hub of the gear pinion has a clutch tooth $f^1$, and the hub of the crank P another clutch tooth $h^1$, engaging with the former. After the pinion F and gear E have been engaged by means of handle N, the engine is put in motion by means of crank P, and pinion and gear are again disconnected.

657,056—Reversing Gear Mechanism.—Carl H. Blomstrom, of Marquette, Mich., August 28, 1900. Application filed February 26, 1900.

This is a reversing gear with differential motion (quick return), and specially suited for certain machine tools, but also applicable to other purposes. The shaft B, carrying at one end a pulley $B^1$, is supported by the hangers a a. The other end of the shaft is mounted in a long sleeve $B^2$. The driven member is a cone pulley, on the hub of which is keyed a bevel pinion D. A similar, but larger, bevel pinion $D^1$ is keyed to the shaft. These two bevel pinions are connected by two others, E and $E^1$, mounted on pins e $e^1$, screwed into the loose hub F. Over these pinions and around the pins e are washers G $G^1$. These washers and the pins e $e^1$ are provided with slots, through

Fig. 1.



which pass the wedge-shaped arms H. The arms H are pivotally connected to a disc K with a large hub sliding closely on the shaft. At its outer end this hub is provided with teeth $K^1$, which will engage with corresponding teeth $K^2$ on the journal sleeve $a^3$. The hub and disk K can be moved laterally on the shaft by means of a shifting lever $K^5$.

In the drawing the disc is shown in the extreme right hand position. The wedges H force the washers G down upon the pinions E, thus preventing the latter from rotating around the pins. Pulley C rotates in the same direction and at the same velocity as shaft B. When the disk K is brought to the other extreme of its motion, its teeth will engage with those of the journal sleeve $a^3$, and it will thereby be locked in position. Pinion $D^1$ will transmit the rotation of the shaft to pinion D, through the intermediary of pinions E $E^1$. The rotation of pinion D, and consequently of the pulley C, will be faster than, and in the opposite direction from, the rotation of shaft B.

657,057—Gear Mechanism.—Carl H. Blomstrom, of Marquette, Mich., August 28, 1900. Application filed February 26, 1900.

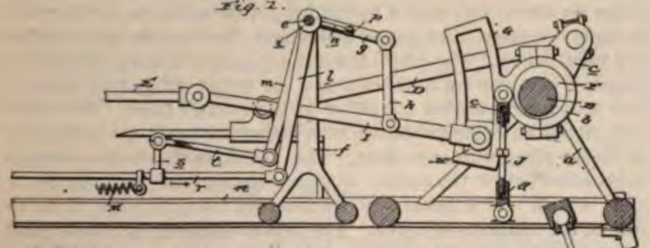
This is a variation of the preceding, adapting it to gasoline launch use.

655,927—Valve-Gear—Charles D. P. Gibson, of Jersey City, N. J., August 14, 1900. Application filed July 18, 1899.

This invention comprises a valve-gear for fluid pressure engines, permitting the engine to be quickly reversed when so desired by the engineer, but which will effectually prevent a casual reversal of the engine.

In the drawings A is the bed of an engine, B a drive shaft journaled in standards a, and equipped with cranks C; E are the valve rods, and D the crank connection rods.

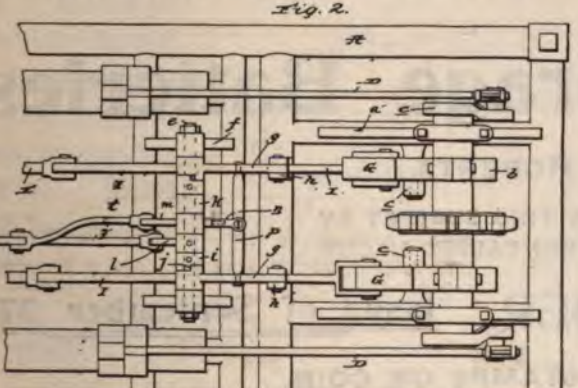
Fig. 1.



The cranks C are disposed as shown, and hence it is necessary to simultaneously move the pistons in opposite directions. To this end there is provided a valve gear, comprising oppositely disposed eccentrics F, on the shaft B, links G having straps and receiving the eccentrics, link blocks H, arranged in the links, and rods I interposed between, and pivotally connected to the link blocks and valve-rods E. For adjusting the links, the turn rods J are provided.

The reversing mechanism is supported by a shaft e, arranged in standards f, and comprises arms g loose on the shaft e and

Fig. 2.

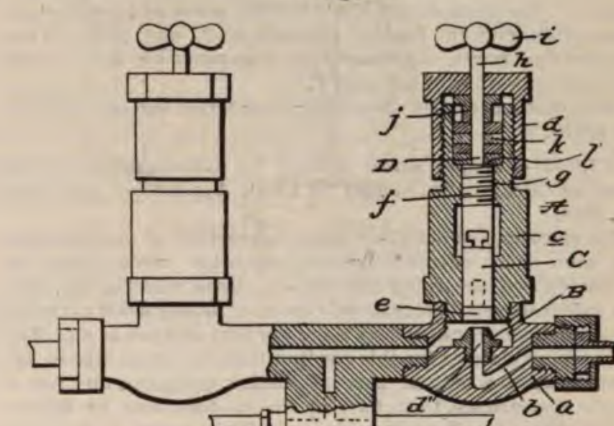


connected by links h on the rods I, collars i fast to the shaft e, and having shoulders, designed for the engagement of similar shoulders on the arms g, a special collar k, loose on the shaft a lever l, fast on the shaft e, a lever m loose on the shaft e, and having an arm n, connected to a resilient strap p, interposed between the arms g, a rod r, having a lateral arm s, and a link t connecting the arm s and the lever m. The rod r is designed to be connected to a suitable handle, and when it is moved in the direction of the arrow, and the lever l is swung forwardly, the lower shoulders j of the collars i, abutting against the lower shoulders of the arms g, will swing these arms and the rods L upwardly, and thereby raise the blocks H to the upper ends of the links G and reverse the engine. At the same time the lever m is swung forward at a greater rate of angular speed than the lever l, and its arm n is swung upwards, faster than the arms g, with the result that when the arms g reach their highest position the resilient strap f will be bowed upwardly, and consequently hold the link blocks H securely in place. When, on the other hand, the link blocks H are brought to the lower end of links G, strap h will be bowed downwardly and hold the link blocks against any casual upward movement.

655,928—Reciprocating Valve—Charles D. P. Gibson, of Jersey City, N. J., August 14, 1900. Application filed July 18, 1899.

The patent refers to a valve particularly adapted to carbonic acid gas motors, and designed to prevent leakage of the gas from the valve casing when the valve is open.

Fig. 1.



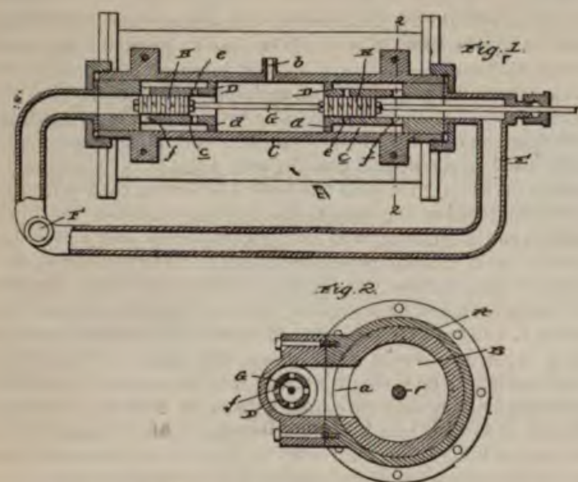
A is the casing of the valve, having a body a with a port or passage b, a bonnet c and a gland d screwed on the outer end of the bonnet. D is a nipple of hard metal, with its outer end more or less beveled. C is a reciprocating valve body of angular form in transverse section, adapted to move endwise in the correspondingly shaped interior of the bonnet c. This valve body C is provided with a removable face e, of a metal softer than the nipple B. D is a valve stem, which is connected in a swiveled manner to the end of the valve body C.

To prevent leakage of the gas when the valve is open there is provided within the casing-bonnet c, and upon the reduced portion h of the valve-stem, a metallic collar j and a plurality of superposed washers k, of felt or other compressible material. When the valve is open the valve-stem compresses the washers k, and spreads them against the interior of the bonnet, thus effectually preventing the escape of gas.

655,92 —Piston-Valve for Engines.—Charles D. P. Gibson, of Jersey City, N. J., August 14, 1900. Application filed August 28, 1899.

The invention relates to a reciprocating valve specially adapted for use with motive fluids under high pressure.

A denotes an engine cylinder and C the valve chest, connected to the former by ports a at each end of the cylinder. At an in-



termediate point of its length, the valve-chest has an opening b for the admission of the working fluid. Chest C contains two bushings D, and its opposite ends are connected by a conduit E with an exhaust F. The bushings have a smaller diameter than the chest, and have annular heads d at the inner end, and also two sets of ports e,f, for connecting their interiors with the annular spaces, which are always in communication with the ports a. The ports e e are the induction ports and are in communication with the central steam-chest C, and ports f f are the eduction ports, of greater area than ports e e, and in communication with exhaust pipe F.

The drawings clearly show the construction and operation of the valve.

657,046—Multiple Motor System for Automobiles.—John Trier, of Chicago, Ills., August 28, 1900. Application filed April 26, 1900.

The specification describes an arrangement of multiple electric motors for automobiles and controller connections for operating and governing the motors. Each wheel of the driving axle is driven independently from a motor shaft carrying two electric motors, so that there are four motors in all. The advantages claimed for this construction, by the inventor, are that the motors become thus of smaller diameter, and are of neater appearance, that two of the motors may be disconnected from the battery when only little power is required, thus economizing the charge, and that the system permits of an efficient and perfect control. (It might be well in this connection to remember the higher first cost, greater weight and smaller efficiency of two motors, as compared with one larger motor of equal capacity. E. H. A.)

## GASOLINE VALVE AND CARBURETER.

The Avery & Jenness Co. of Chicago, Ills., are manufacturing a gasoline controlling valve, and also a carbureter.

The gasoline controlling valve or register valve, as it is called by its manufacturers, is of the well-known needle valve type, but possesses a number of special features of design, which are claimed to make it unusually reliable and uniform in action. The wheel at the end of the valve-stem is provided with ten notches at its circumference, and these notches are designated by numbers, so that when one once knows the proper opening, to be given to the valve, the head of the stem may be turned to the proper position without any experimenting. Into the notches fits a flexible stop, as seen from the illustration, and there is, therefore, no danger of the opening of the valve being changed by the vibration of the vehicle. The gasoline arriving from the tank is strained by a wire gauze, and fills the reservoir of the main fitting, which latter forms a trap for small air bubbles in the supply pipe.

The carbureter, it is stated, is based on a new principle, and has been subjected to a series of tests which have given very satisfactory results. By means of valve A the mixture is regulated, while the lever-arm E controls the admission. The dimensions of a carbureter suitable for engines of from 1 to 4 h. p. are 10x3 inches, and the dimensions of a carbureter for engines of 4 to 8 h. p. are 12x4 inches. These carbureters are made of brass and can be nickeled if desired.

## A MOTOR BICYCLE OF NOVEL DESIGN.

Among the numerous attempts which have been made to build a satisfactory motor bicycle, that recently completed by Messrs. Perks and Birch, of Coventry, is interesting. In this machine an air-cooled petrol motor, together with its carbureter, magneto-igniter, and speed-reduction gearing, is fixed inside the back wheel. The wheel itself is composed of two aluminum cages, which run on ball bearings on either side of the motor, and which are bolted together at their outer faces. The steel rim, fitted with a pneumatic tire, is carried upon the periphery of these aluminum castings. The crank-shaft of the vertical motor lies below the center of the driving axle, and carries a spur wheel, which gears into an internal toothed rack, fixed to one of the aluminum cages. The relative speeds of motor and road wheel are as 7 to 1, approximately. Only one regulating lever is fitted, and this consists of a hand lever on the handle bars of the cycle; in one position this lever reduces the compression in the cylinder for starting and in the opposite positions it controls the explosive mixture. The machine only differs from an ordinary bicycle as regards the back wheel, the rear forks and the increased width between the cranks; its weight is about 1 cwt. A very brief trial run upon the cycle in question proved its hill-climbing powers, its ease of management and its smoothness of running.—*Automotor Journal.*

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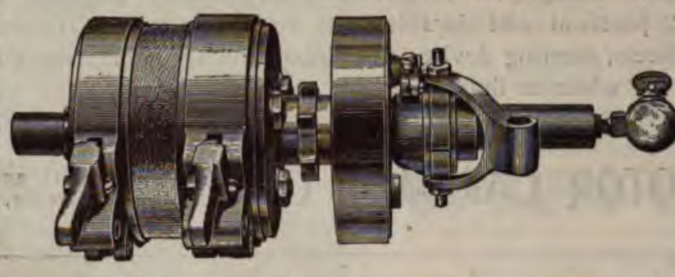

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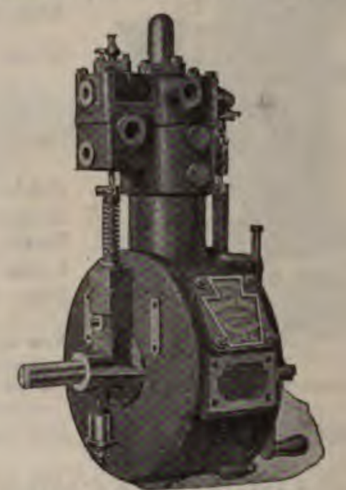

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Reflecter attached to Steering Gear. Water Tank carried under seat. **AUTOMATIC** in **OPERATION.**
**COST** to operate, 1 cent for 2 hours.

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It furnishes a dry, perfectly mixed gas, with the greatest expansion and easiest ignition. Designed especially for Automobiles, Motor-cycles and Launches.

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## St. Louis Automobile and Supply Co.

23d and ST. CHARLES STS., ST. LOUIS, MO.

THE HORSELESS AGE

...EVERY WEDNESDAY...

Devoted to Motor Interests

VOLUME VI NEW YORK, SEPTEMBER 26, 1900 NUMBER 26

# THE HORSELESS AGE.

E. P. INGERSOLL, EDITOR AND PROPRIETOR.

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## SPECIAL NUMBER FOR THE NEW YORK AUTOMOBILE SHOW.

The latter part of the week of the Automobile Trade Show, to be held under the auspices of the Automobile Club of America at Madison Square Garden, New York, November 3d to 10th, we shall issue a special number entitled "A Critical Review of the American Automobile Industry," as shown by the exhibits there presented.

Our entire staff of technical contributors and specialists, together with skilled users capable of criticising the automobile intelligently from their point of view, will combine to make this number larger and more valuable than our Steam Boiler and Explosive Motor numbers, of which the total sales have reached 13,000 copies. The price of this number, which will contain 80 to 100 pages, will be 25 cents. Notwithstanding the increase in size and circulation, the advertising rates will not be raised.

The special numbers issued by THE HORSELESS AGE are real contributions to automobile literature and are of permanent value. At the rate charged, the advertising is decidedly cheap, and those who have any articles which they wish to bring before the industry are advised to make use of this number. Copies may be ordered at once, either through news dealers or direct from this office.

Our Automobile Show number will furnish food for thought for all. It will be automobile mechanics up to date and a little more.

## DANGEROUS PRESSURES.

It is stated that a steam vehicle taking part in the Inter-Ocean contests at Chicago, last week, worked with a boiler pressure of 800 pounds to the square inch. The first thought that occurs to one upon hearing this statement is, that if the engine was of the usual size, and the boiler capable of keeping up this pressure, the vehicle must have made a good showing as regards speeds. But there is another feature which, upon further consideration, will impress itself upon the impartial observer, viz.: the danger of explosion of a shell boiler carrying such an enormous pressure, and mounted upon a vehicle going at the terrific speeds of modern racing machines. The appearance of such machines upon a crowded track is a matter of serious moment, as an accident occurring under such circumstances would undoubtedly greatly affect public sentiment, might become the cause of legislative restrictions harmful to the progress of the industry. That nothing has happened is not a disproof of our contentions.

Motor vehicle accidents are rather too frequent now, and as there are no effects without causes it is a proof that danger does exist. A large number of accidents are attributed to carelessness or incompetence of the operators, but this is a factor which must be reckoned with in the design of vehicles, as at present anybody has the right to operate a vehicle of any kind anywhere in the United States, with the exception of a few of the larger cities. We are of the conviction that a reasonable license law requiring operators of steam vehicles to have a fair understanding of the mode of operation of their power generating apparatus, and of the functions of the various attachments, would be to the interest of the industry in general, for what the latter needs most is not a boom-creating wave of

popular enthusiasm induced by extraordinary performances made possible by unsafe pressures and flimsiness of construction, but a normal and steady advance, avoiding all risk of disaster.

As the pressure carried in the boilers of all steam carriages is considerably beyond that of the ordinary stationary plant, and as the danger of any steam plant increases with the boiler pressure (other things being equal), it is but a fair proposition that boilers of vehicles should be subject to regular inspection the same as all stationary boilers. Although, unfortunately, boiler explosions have as yet to be recorded, too frequently there is no doubt that the inspection system of the various boiler insurance companies has done much to reduce their number, and the boiler insurance system could advantageously be extended to include vehicle boilers. With an insurance certificate in his possession a vehicle operator would feel sure that, according to the judgment of competent steam experts, his boiler is of proper design and construction, and that at the time of inspection it was still in a fit condition to do service.

## NEWSPAPER BLUNDERS.

As a fair example of the blundering of the daily press in matters pertaining to automobiles, we quote the following:

"The superiority of the French automobile was clearly demonstrated at Washington Park, Chicago, yesterday. Albert Champion, the old-time cyclist, was entered with his double motor against the machines of Wridgeway, an Englishman, and Skinner, an American. Champion won the 15-mile contest by several hundred yards, with Skinner second and the Englishman a hopeless third. The time was 29 minutes, 47$\frac{2}{5}$ seconds. Alexander Winton, who is expecting an automobile match with W. K. Vanderbilt, Jr., sent his machine a mile in a minute and 18 seconds on a muddy track. This was considered remarkably fast."

As a matter of fact, all contestants mentioned rode French motors: Champion an Aster and Skinner and Wridgeway De Dion motors. Champion's tricycle was fitted with two motors of nominal 3 h. p., while Skinner had one motor of nominal 4 h. p., and Wridgeway one motor of 2½ h. p. Notwithstanding the inequality of horse power, the superiority of the De Dion motors was apparent to every observer. They worked reliably with no reduction of speed until the setting of the inlet valve on Saturday, while the competing motor seemed incapable of sustained speed for any length of time, owing to repeated failure of its mechanism. We desire to single this out as a conspicuous instance of the radical injustice that is done y the present illogical method of organizing automobile races.

## CHICAGO AUTOMOBILE CLUB'S FORTH COMING SHOW.

The Chicago Automobile Club authorizes the announcement that some time in May or June next it will hold an automobile exhibition and race meet in Chicago, the details of which are yet to be arranged. In making the announcement at this early day, the club wishes to give to manufacturers ample time for preparation, particularly for the construction of racing vehicles, the lack of which in this country has seriously crippled racing events organized up to this time.

## THE GUTTENBURG RACES.

The opening of the Tri-State Fair at Guttenberg, N. J., on Tuesday the 18th, was marked by a series of automobile races, which included an event of more than ordinary interest, the appearance of A. C. Bostwick, with his Rene de Knyf racer, with which he made the excellent time of five miles in 7.43$\frac{1}{5}$ over a mile track. The program included the following events:

Gasoline Vehicles, American made, five miles—T. Walsh, (Automobile Co. of America), New York, won: F. Nagel, (Automobile Co. of America), New York, second; Albert C. Bostwick (Winton), New York, third. Time, 10 m. 10$\frac{3}{5}$ s.

Three-wheeled Vehicles, five miles—C. S. Henshaw (De Dion-Bouton), New York, won; J. Lauvaguez, New York, second; S. R. Atkinson, New York, third. Time, 8m. 24$\frac{2}{5}$ s.

Electric Vehicles, five miles—A. L. Riker, Elizabeth, had a walkover.

Gasoline Vehicles, two passenger (over 1,000 pounds), five miles—Albert C. Bostwick, New York, won; DeWolfe Bishop, Newport, second. Time, 7 m. 43$\frac{1}{5}$ s.

Gasoline Vehicles, two passengers (weight less than 1,000 pounds), five miles—C. J. Field (DeDion-Bouton), New York, won; F. T. Craven, New York, second; J. Lauvagne, New York, third. Time, 11m. 43$\frac{3}{5}$ s.

Steam Vehicles, two passengers, five miles—W. J. Stewart, Newark, won; W. L. Hibbard, New York, second; J. Hueston, New York, third. Time, 11m. 48s.

Championship, open to prize winners in four other events, 10 miles—Albert C. Bostwick, New York, won; DeWolfe Bishop, Newport, second; A. L. Riker, Elizabeth, third. Time, 15m. 9$\frac{1}{5}$ s.

The obstacle race was won by DeWolfe Bishop, notwithstanding the weight of his machine.

## THE AUTOMOBILE NOT A NUISANCE.

An interesting suit to automobilists was tried at Hackensack, N. J., last Thursday. John L. Guyre, of Walwick, sued Dr. William L. Vroom, of Ridgewood, for damages for the loss of his wife, who was thrown from her buggy at Midland Park last January, and died from the effects of her injuries in August. Witnesses testified that Dr. Vroom's automobile, being beyond his control, backed into, or very nearly into, the horse driven by Mrs. Guyre, causing the animal to run away and throw her out. Dr. Vroom's testimony was that the horse was frightened and turned when 275 feet away from the automobile, which he stopped upon seeing that the animal was afraid. He said that he had the machine under perfect control and gave an exhibition in front of the court house to show the court and jury his ability to handle it. In instructing the jury, the justice said:

"The first question to which you come for the purpose of deciding the defendant's responsibility is whether this machine was a nuisance. You have seen how it was operated. You have heard the witness describe the mode of operation, and the question rests with your sound judgment as to whether the machine, driving along the country roads without a horse in front and discharging steam behind, is likely to frighten a horse on the highway, and thus endanger the road as to constitute the machine a nuisance. It is agreed that it is an improved method of locomotion, but it does not follow from that that it is to be tolerated. The right to drive horses along the highway is an established right, a common right, and if a modern method of locomotion is used of such a nature that it commonly brings discomfort and danger to those exercising the common right, the established right of travel on the highway, then it is a nuisance and cannot be tolerated. If it occasionally or exceptionally frightens horses that would not make it a nuisance. In order to make it a nuisance its common effect must substantially interfere with the people who drive horses along the highway."

After being out a few minutes the jury returned for further instructions on one point, at the same time informing the Court that it had agreed that the automobile was not a nuisance.

## THE INTER-OCEAN TOURNAMENT.

By E. C. Oliver, M.E.

The First International Automobile Exhibition and Tournament at Chicago, under the auspices of the Inter-Ocean, closed Tuesday, September 25, it being continued two days in order to make time for races delayed on account of bad weather.

The exhibition may be considered a success from the standpoint of the builders, as they report many sales at the grounds. However, very little was shown which was new in principle, only the familiar types being exhibited. The attendance was rather light.

The principle exhibitors were as follows:

The Woods Motor Vehicle Company (electric), about twenty vehicles of various types, including road wagons, delivery and mail wagons, hacks, cabs, etc.

The Mobile Company of America (steam), 12 vehicles of the runabout type.

The Chicago Motor Vehicle Company (gasoline), several vehicles with interchangeable bodies.

The American Bicycle Company, several types of Waverly electric vehicles, a Rambler gasoline carriage and tricycles.

The Hewitt Lindstrom (electric), five machines, including omnibus, Stanhope and runabout types.

The Locomobile Company of America (steam), several two and four passenger machines.

The St. Louis Motor Carriage Company (gasoline), two road carriages.

The Ohio Automobile Company (gasoline), two carriages—one a standard road machine and one a special high-speed road machine.

The Milwaukee Automobile Company, two steam runabouts and a standard running gear.

The De Dion-Bouton Company (gasoline), a "Motorette" and tricycle.

Olds Motor Works, electric standhope.

Eastman Automobile Company, several pressed steel bodies.

The exhibitors of sundries were: Springfield Tire Company, United States Ball Bearing Company, Wells folding buggy top, Lemp steering check, Apple gas engine igniter, Helios-Upton storage batteries, Motsinger auto sparker and Buffalo Gas Engine Company.

The racing interest was centered in the fast machine of Alexander Winton and the tricycles ridden by Champion and Skin-

Rambler Gasoline Stanhope of the American Bicycle Co.

THE LOCOMOBILE RACER.

THE WINTON RACER.

ner. Probably the most interesting race took place Tuesday between Winton and Skinner, for 10 miles, won by Winton in 16:02 2-5, the pair keeping close together throughout the race and changing lead several times. The fastest time for one mile

EXHIBITION OF POWER CONTROL BY THE CHICAGO MOTOR VEHICLE CO.


CLIMBING TO THE 35 PER CENT GRADE.

was 1:08. T. E. Griffin, in a locomobile racing machine, is recorded to have made a mile in 1:06, although many of the experts who timed his machine deny this.

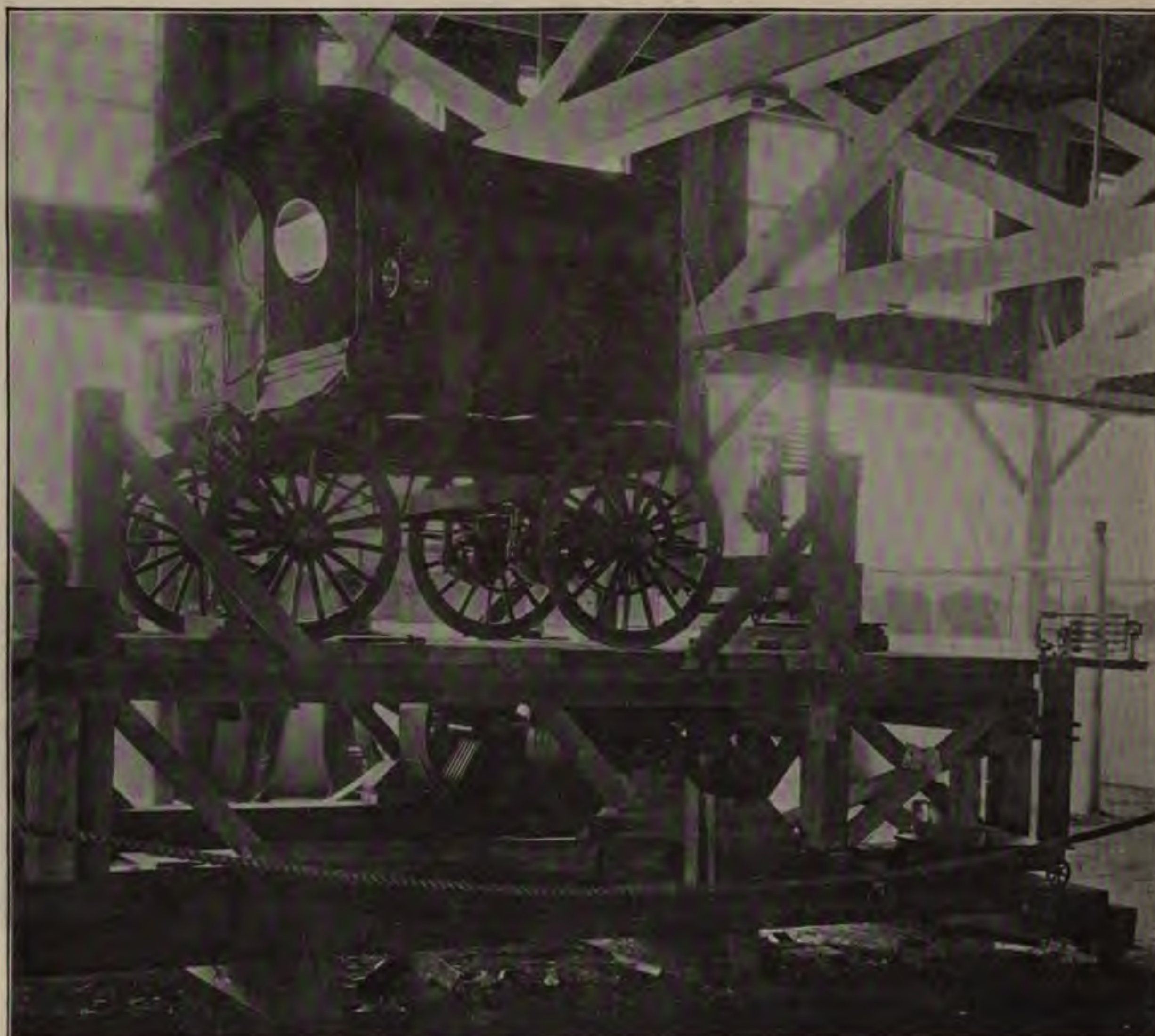
Some clever handling was shown by "Jack" Worth with a Chicago gasoline delivery wagon. A large framework was built in front of the grandstand after the manner of a see-saw, up which the machine was driven and worked back and forth across the center causing the frame to rock; while on the framework a box was placed in the track of the wheel and the machine carried over it with such control that an egg placed on the opposite side of the box was cracked but not crushed. The machine was also driven up a grade of 30°.

Mechanically, there was little shown that was new. The Rambler carriage was noteworthy in differing radically from the other machines. In this carriage was a starting device operated from the seat. It consisted of a ratchet wheel on the cam-shaft of the engine, which was engaged and turned by a pawl on a hand lever, the movement of the hand in pulling the lever forward engaging the pawl, which is at other times held out of contact by a spring. The motor, instead of being under the seat or behind the operator, is placed in front of the carriage, distributing the load more nearly equal and is at all times accessible by raising a cover. The tubes for cooling the jacket water are placed in front as, in French machines, and are supplemented with radiating fins of thin brass.

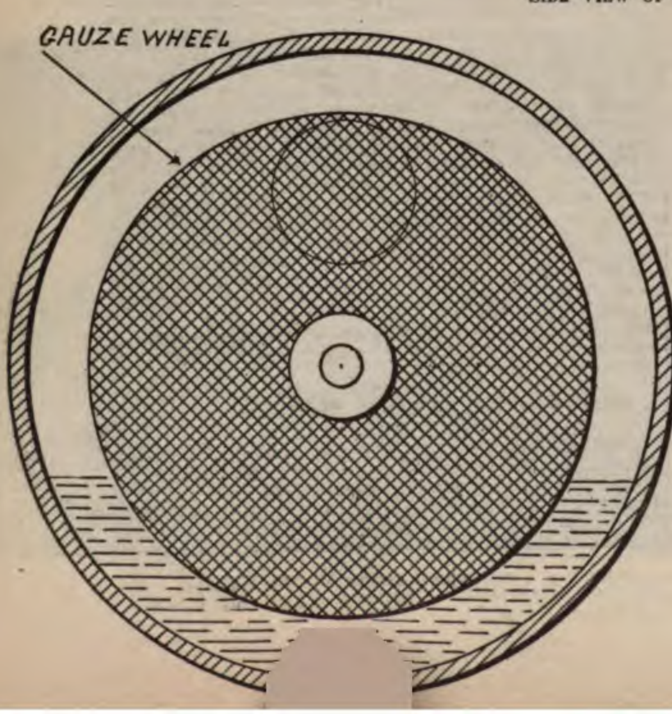
The carburetter, or vaporizer, used on this machine is shown in the accompanying sketch. It consists of a circular brass chamber in which is a wire-gauze disk rotated by gearing to the cam shaft of the engine; the lower part of this disk is immersed in gasoline and on revolving carries a thin film across the air inlet; the mixture is adjusted by changing the size of this inlet.

In the Packard carriage has been eliminated many of the faults generally accompanying the gasoline machine. It is

THE LAWSON MOTOR WHEEL.



SIDE VIEW OF TESTING APPARATUS.




practically noiseless and has very little vibration—practically none—when the carriage is running. The speed is regulated by a pedal, and the various speeds and brake by one lever. One distinctive feature is its rim brake, used only for emergency. It consists of a curved band of steel, attached to the inside of the rear wheels, on which two shoes of wood may be set by a foot lever.

The gasoline machines all employ one or two cylinders; for cycle engines none being shown having a greater number than two.

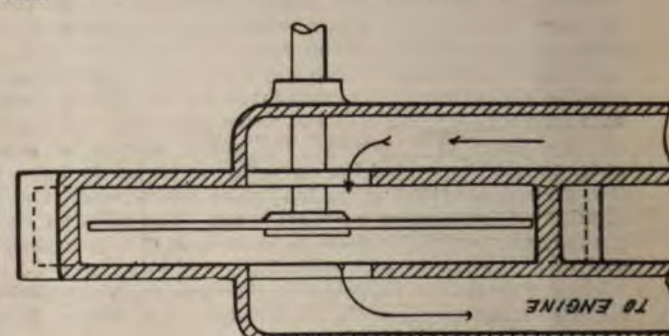
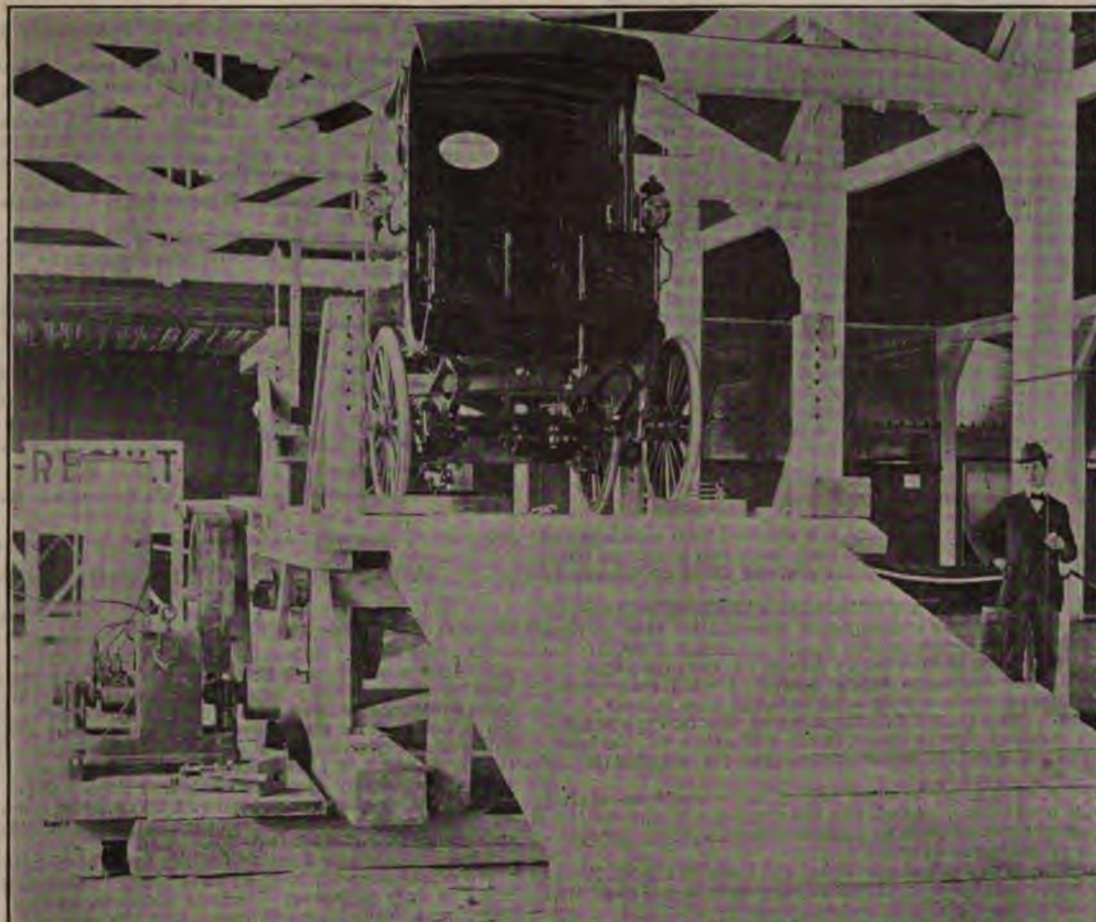



FIG. I.



END VIEW OF TESTING APPARATUS.

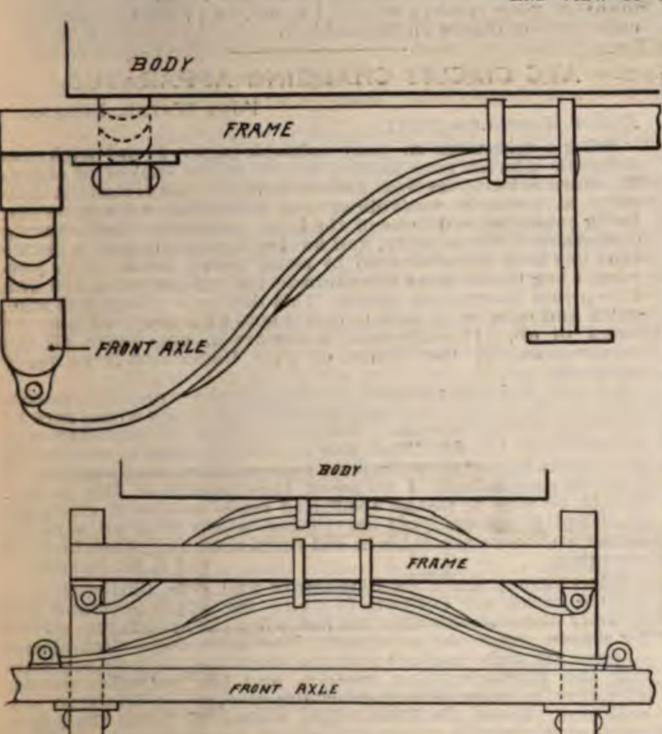



FIG. 2.

In the frames or running gears were a few having horizontal King bolts, to allow the carriage to adapt itself to varying road surfaces, but by far the greater majority depended on the spring of the frame or the action of the springs for adjustment.

The arrangement used by the Woods Motor Vehicle Co. is shown in sketch No. 2.

The application of steam to carriages offered no choice whatever; the several companies building steam machines have the same design throughout, differing only in slight details. The vertical marine engine is used and a five-tube shell boiler.

The utility tests were made with a machine of the general design shown in THE HORSELESS AGE of April 18, 1900, and may be clearly understood by reference to the cuts shown herewith; the carriage is seen with the driving wheels resting on two supporting pulleys; the machine is secured by wire ropes to a series of links which transmit the pull or tractive effort to a scale platform; friction in addition to the friction of the supporting shaft may be applied by a brake attached to the pulley in front of the machine. The apparatus is also arranged to be run by an electric motor, which allows the friction losses to be obtained running the carriage from the motor. The apparatus was so heavily and crudely constructed that it would seem doubtful if results obtained therefrom would be exact or comparable.

These tests were made on a Milwaukee steam automobile, a Hewitt-Lindstrom electric delivery wagon, and a Rambler gasoline carriage.

## ADDITIONAL SHOW NOTES.

### APPLE AUTOMATIC IGNITER.

This machine, the latest product of the Dayton Electrical Mfg. Co., caused much favorable comment. It weighs 20 pounds (with spark coil in base 30 pounds), is 5½x7½x10½ inches in size, has a centrifugal governor, and is water and dirt proof. It is a cross between the magneto and dynamo, having permanent magnet pole pieces, which are kept up to the same strength by the field coils while the dynamo is running, giving the one advantage of a magneto in that it picks up its load quickly and yet doing away with the magneto's weakest point, the *magnets dying*.

SNATCHED VICTORY FROM DEFEAT.

The racing events were, as a rule, not closely contested on account of the lack of racing machines in the United States at the present time. The motor tricycle races seemed most interesting to the spectators on account of the sustained speed of the machines and the able manner in which they were handled by their riders. One of the most exciting events was the 50 mile race for motor tricycles on Saturday, in which Champion, riding a machine fitted with two Aster motors, snatched victory from defeat, when Skinner, after reeling off over 40 miles with that regularity of action which has made the De Dion motors famous among the air-cooled types, and leading the Frenchman by half a mile, was unfortunately put out of the race by the setting of the inlet valve of his motor, due, as was said, to carbonization, owing to the excessive amount of gasoline he was feeding into the machine. Skinner used one of the large-sized cylinders, developing about 3½ horse power, while Champion's two cylinders are rated at six horse power. Wridgeway, the third entry in these races, had a 2½ horse power motor, and consequently was hopelessly handicapped. The Aster motor gave frequent trouble in each event, showing well at the start, but slowing down after a few miles, and thereafter intermittently regaining its normal speed only to fall back again.

NEW ST. LOUIS MODEL.

The St. Louis Motor Carriage Co. showed two carriages of their latest design, one of which had been run overland from St. Louis to the grounds without serious delay or mishap of any kind.

The engine and gearing are self-contained and can be removed from the carriage by the loosening of four bolts. One friction clutch operates the gears, which run in oil in the base of the engine. Lubrication is effected by means of two oil cups, the phosphor bronze bearings being provided with ring oilers, which it is necessary to supply with oil only once a week.

The water tanks, paneled in the sides of the body, are furnished with cooling fins to assist in the radiation of the heat, and the steering gear is fully compensated for strains in all directions.

The motor, of 6 h. p., has but one cylinder and is mounted on an angle iron frame. As all the bearings are in one casting they cannot get out of line, and one serious cause of derangement from vibration is avoided.

The rear axle is of Bethlehem Nickel steel, which the St. Louis Company reports is the only material they have found that will stand the strains.

Other details that may be mentioned are cotter-pinned bolts, Baldwin drive chains, the Auto sparker for igniting the charge, (which has proved a most satisfactory device, having been used in the run from St. Louis without batteries even for starting the motor), and a powerful toggle joint brake that will slip the wheels.

The weight of the machine is 1,300 pounds, and a practical test of its hill-climbing capacity was made on the grounds when it ascended to the 35% mark.

The St. Louis Motor Carriage Co. wish to state that they are not connected with any other motor concern in St. Louis and that they do not make any parts, but confine themselves to the production of complete carriages.

On Saturday Alexander Winton made a 50-mile run against time in 1 h. 17 m. 50 s.

Skinner won the hour record for the De Dion, making 40 miles 132 yards. The 50-mile record went to Champion, time 1 hr. 15 m. 58 s.

NEW MODEL OF THE ST. LOUIS COMPANY.

## ...COMMUNICATIONS...

### AIR-COOLED MOTOR PHILOSOPHY.

NEW YORK, Sept. 18.

*Editor* HORSELESS AGE:

In answer to "Subscriber" as to the maximum allowable dimensions of air-cooled engines, I would say that it is more a matter of geography and seasons than anything else. The past summer has been a hard one on air-cooled motors around New York. The tendency to overheat and stop every few miles is not conducive to ease of mind, or morality of speech, and next summer I will have a water-cooled engine if it is only a 1-inch x 2-inch. Some of the latest French 2¾-h. p. air-cooled motors, with the thermometer at 95 degrees, are not a fit summer companion for ministers of the Gospel or others having a due regard for their future life.

This summer the English papers have been full of articles on "Why does a motor stop when it heats?" showing that we are not the only sufferers. Various theories, backed up by much argument, have been advanced, but the one which ascribes the trouble to the high rarefaction, and consequent smallness of the incoming charge, I believe to be the true one. However, many of your readers would, I know, be pleased to have the experience of others on this subject. E. T. B.

### ARC CIRCUIT CHARGING APPARATUS.

FORT WAYNE, INDIANA.

*Editor* HORSELESS AGE:

Being a subscriber to your valuable paper, I read with considerable interest your leading article on the subject of charging storage batteries from arc circuits, and the attendant difficulty in properly controlling the switching arrangements. Being connected with one of the large electrical manufacturing companies of the country, and having repeatedly used a device that has been manufactured by us for years, for this very purpose, I beg to call your attention to the inclosed circulars and blue-prints illustrating same. This device is absolutely safe, quick and reliable in action, and is sold at a price within the reach of all. It is fire and water-proof, and meets all the requirements of the Board of Fire Underwriters in every particular.

I would be further pleased to arrange to have one of these cut-outs sent to you for trial and investigation, if you would care to have one for this purpose. We have lately made improvements in several of the details of this cut-out, making it absolutely up-to-date in every particular. I am satisfied that numbers of your correspondents, if aware of the existence of this device, would be able to install a safe and ready means of charging their batteries from local arc circuits, which, after all, is really better and more available in 101 cases than any other form of charging. E. H. BARNES.

[Mr. Barnes sends us blue-prints and cuts illustrating a double break arc cut-out, in which the house terminals are entirely disconnected from the line when the apparatus, served by the cut-out, is out of circuit. The moveable switch blades apparently make contact with the house terminals before leaving the short-circuiting contact, and the batteries would, therefore, be momentarily short-circuited, as explained in our editorial. From the illustration, we would judge the apparatus well adapted to the purpose of charging batteries from arc circuits.—ED.]

## LOUIS P. MOOERS' GASOLINE CARRIAGE.

Louis P. Mooers, of New Haven, Conn., has designed a light gasoline vehicle, of which some drawings and details are herewith given.

The general style of Mr. Mooers' vehicle is that of a runabout. It has 32-inch wire wheels with 2½-inch pneumatic tires. The wheel base is 5 feet, and the track 4 feet 6 inches. The frame of the carriage is of steel tubing.

The vehicle is propelled by a single cylinder, double piston, gasoline engine, of 4½-inch bore and 6-inch stroke, which develops 4 h. p. at a speed of 700 revolutions per minute. It is claimed that the engine will easily run up to 1,200 revolutions per minute, as the stroke of each piston is only 3 inches, and the piston speed at this number of revolutions is, therefore, not excessive. The engine is said to run even steadier at this than at the ordinary speed. The ignition is electric, and of the jump-spark type, and the terminal plug projects into the combustion chamber ⅜ inch, which keeps the porcelain clean, as the passage of the incoming charge prevents the accumulation of dirt on it. The cylinder is provided with two oil cups, one for each piston.

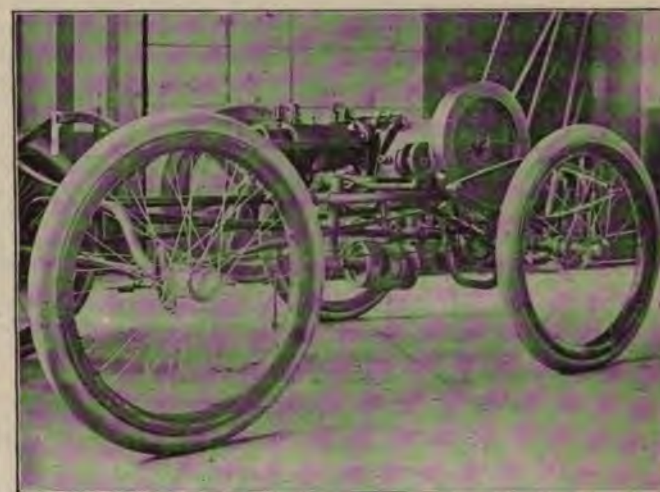
Louis P. Mooers' Gasoline Carriage.

The total weight of the carriage is 770 pounds. The capacity of the gasoline tank is five gallons, and that of the water tank six gallons. The water is circulated by means of a centrifugal pump, which is driven from the fly wheel by friction. The friction wheel of the pump is held against the fly wheel by means of a spring, and in this way the use of a belt is done away with, thus avoiding the constant bother of having to take up the belt.

The power is transmitted by spur gears from the engine shaft to a countershaft carrying the friction clutches. Two forward speeds and one reverse are provided. From the countershaft the power is transmitted to the driving axle by means of a chain. The ratios of reduction from engine shaft to driving axle for the two forward speeds are 4 and 12 respectively. Intermediate speeds may be obtained by varying the time of ignition.

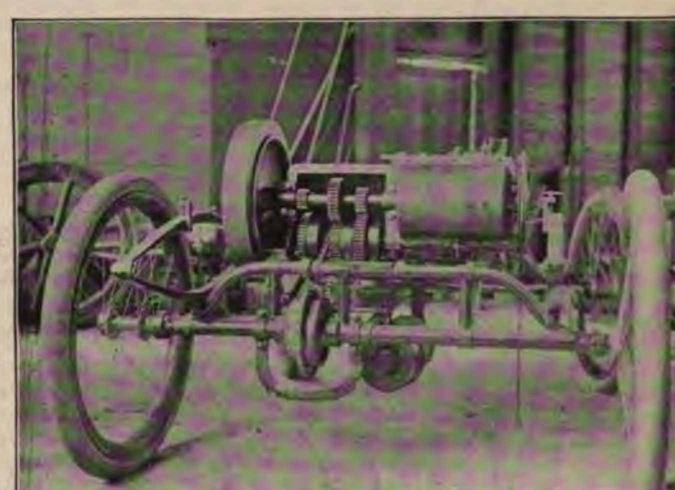
The steering is effected by knuckle joint pivoted front axles.

The three friction clutches are operated by means of a rod passing through the hollow countershaft. The construction of the friction clutches is shown on page 18. A spur gear wheel of cast steel is provided with a brass sleeve, and runs loose upon the shaft. This wheel is cast with a drum on its web, the outer surface of which forms one of the friction surfaces. The other member of the friction clutch is also of cast steel, and is keyed to the shaft. This member also forms a drum, which is finished on the inside, and has an internal diameter about ⅝ inch larger than the external diameter of the drum, cast integral with the gear wheel. Between these two members of the friction



Side View of Frame.

clutch there is a split cast-iron ring or spring B, with a bore $\frac{1}{32}$ inch larger than the diameter of the inner drum. One end of this split ring is held to the fast member of the clutch by means of an anchor screw C. To the other end of the cast-iron spring is rivited a bunter A, with which engages the arm E of the clutch lever, which is pivoted on the stud D. At the end of its other arm this lever carries an adjustable screw, which passes through the hub of the fast clutch member into the interior of the hollow shaft. As the spring B has a larger bore than the diameter of the inner drum, it is evident that, if there is no



Rear View of Frame.

force acting on the spring, tending to compress it, the spring and the gear wheel will be independent of each other. But if the adjusting screw is forced out by the operating rod inside the hollow shaft, the clutch lever will compress the spring and will make it grip the steel drum, and as the spring is held to the fast member of the clutch by the anchor screw C, this will make the gear rigid on the shaft.

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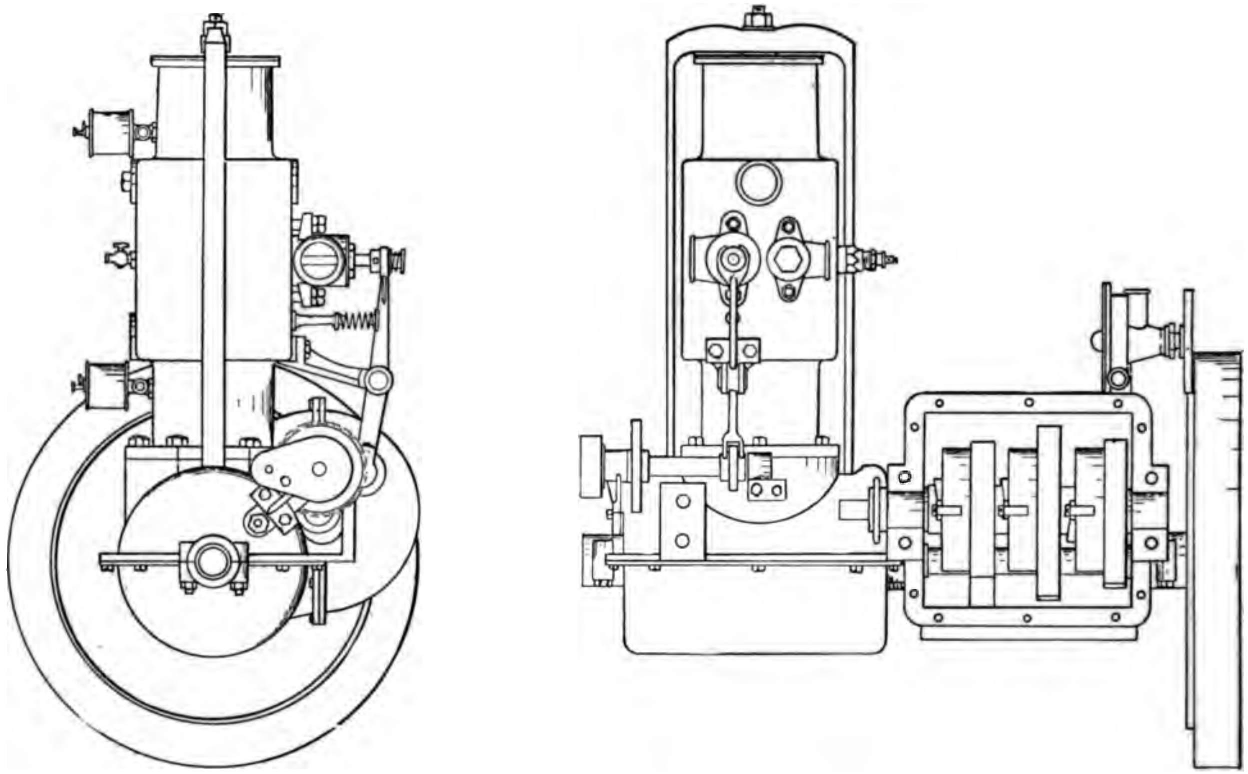
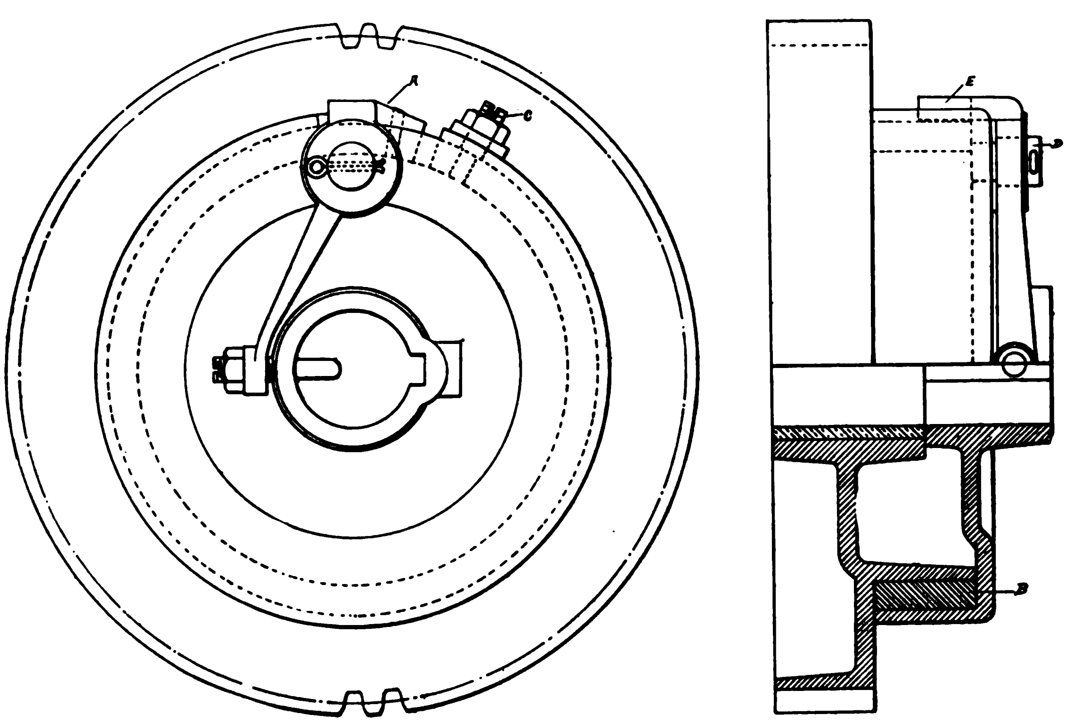
The cycle mounted police, which were stationed in the thoroughfares of Paris frequented by automobiles, shortly after the accident of Croix de Noailles, have been a thorn in the eyes of scorching *chauffeurs* ever since. The latter recently complained that these policemen would ride around after dark at reckless speed and without a lantern on their machines. "A group of cycle policemen" has seen fit to reply to these charges by a letter in *Le Matin*, in which it is explained that if they carried lanterns it would be more difficult for them to successfully pursue the hold-up man making a nocturnal attack upon the peaceful citizen, etc.



Plan and Elevation of Mooers Motor.




Detail of Mooers Clutch Mechanism.

# MINOR MENTION

The Maryland Automobile Co. has taken a factory on Main St., Westernport, Md.

The Wood's Motor Vehicle Co. will hold its annual meeting in Jersey City on October 17.

Brown, Thomson & Co., Hartford, Conn., have secured the agency for the locomobile in that county.

Homer F. Livermore, 85 Pearl street, Boston, Mass., has begun the manufacture of cast steel automobile parts.

W. W. Wheeler, Meriden, Conn., is building a steam motor vehicle engine at the shops of the Meriden Machine Tool Co.

The Riker Motor Vehicle Co., Elizabeth, N. J., are said to have laid off 179 hands pending changes in the gear they have been using.

The American Bridge Co. announce that Mr. Liesing has been appointed general Western representative of the company with headquarters at Chicago, Ill.

The new two-seated carriage of the Haynes-Apperson Co., Kokomo, Ind., is remarkable for absence of vibration, odor and noise, and ease of starting.

Augustus Saltzman, who was sent abroad to investigate self-propelled fire apparatus at the Paris Exposition, is expected home early in October.

The autocarettes, which were put in service at Washington, D. C., were discontinued temporarily last week, as changes were found necessary in the motor equipment.

F. F. Dow, St. John, N. B., has invented a kerosene burner for automobiles, and a vehicle to test its merits is being built at the Edgecombe carriage factory in that place.

The International Power Co. again announce that they will begin the manufacture of "auto trucks" at their Providence works. Electricity and hot water are to be the motive powers this time.

The Scott & Cooper Mfg. Co., St. Louis, Mo., has been incorporated with $20,000 capital to manufacture automobiles. The incorporators are T. K. Cooper, A. D. Scott and F. H. Cooper, all of St. Louis.

The Bowker Automobile & Machine Co., Portland, Me., has been organized with $10,000 capital to manufacture automobiles. Harry G. Sleeper, Natick, Mass., is president and Eugene W. Hunt of Portland, Me., treasurer.

A syndicate of capitalists is endeavoring to secure a franchise for an automobile stage line to run through the East End park system of Cleveland, O. They agree not to charge more than ten cents for the entire trip and want a twenty-five-year franchise.

"Harvey's," the well known tailors, 6 Jackson Boulevard, Chicago, Ill., are taking up automobile outfitting. They furnish leather chauffeur's suits, jackets, trousers, caps and goggles complete in any color found in kid gloves at $50.00 the outfit.

The Thornycroft Steam Wagon Co. of America has been incorporated under New Jersey laws with a capital of $100,000 to manufacture steam vehicles at Paterson, N. J. The incorporators are John Platt, Robert H. Thorpe, John S. Cooke, Frederick W. Cooke and Chas. D. Cooke.

The Cleveland Automobile & Supply Co. has been incorporated with a capital of $25,000, by George Collister, president; Walter Crawford, vice-president; W. W. Wright, secretary, and William F. Sayle, treasurer. Quarters have been secured at 146 Prospect street, Cleveland, O. where storage and repair facilities will be provided.

The works of the Siemens & Halske Electric Company of America, located at Grant, near Chicago, which some months ago were acquired by the General Electric Co., will be shut down. The automobile department of these works, in which electric motors and controllers for automobiles were manufactured, will be transferred to the Fort Wayne, Indiana, works of the G. E. Co.

The Ohio Automobile Co., of Warren, O., has been incorporated under West Virginia law with a capital of $100,000, with the privilege of increasing the same to $500,000. The stockholders are J. W. Packard, W. D. Packard, James P. Gilbert and W. A. Hatcher of Warren, and George L. Weiss of Cleveland, O. The company will manufacture the Packard gasoline carriage.

The steam wagon of the Paul H. White Engineering Works of Indianapolis, which was illustrated and described in our issue of September 19, was designed by Mr. White, former chief engineer of the Indiana Bicycle Co. It is stated that three years were spent in the design and perfection of this wagon. It is the intention of this firm to build to suit purchasers' specifications, trucks and drays for beer, brick, ice, coal, flour and feed; also omnibuses and stage coaches, carrying from 15 to 25 passengers, with baggage, any desired distance.

William Roche, of 42 Vesey street, New York, has recently turned his attention to the improvement of gas and gasoline engine ignition outfits, and has brought out the New Standard Dry Battery, which is claimed to have proven very efficient as a source of current for explosive engine igniters. Mr. Roche uses the jump spark, or high tension method of ignition, and both terminals of the ignition plug are insulated, to minimize the danger of grounds, and consequent leakage of current. A very high economy in the consumption of current is claimed, the outfit not requiring more than one-half of one ampere when in operation.

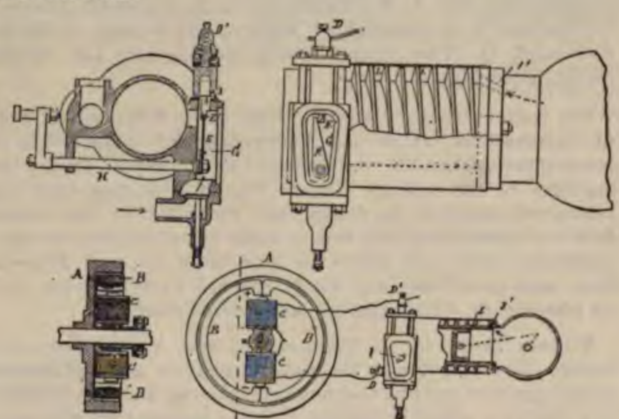
The New York Motor-Vehicle Company have just finished their model public passenger omnibus, and will have it on exhibition at the Automobile Show in the restaurant section of Madison Square Garden. The present model is the outcome of a considerable amount of study and investigation, as the company sent their engineers to Europe to carefully look into the merits of the different motors at all of the great manufacturing centers with the result that they have adopted steam as their motive power. Their model omnibus is made to seat 20 passengers, and differs in style and size from anything so far made in this country.

The De Dion-Bouton Motorette Co., Brooklyn, N. Y., send us word that they are just in receipt of word from England and France in regard to the official records of De Dion motors and motorettes or voiturettes with De Dion motors, in the 1,000-mile run at the Paris Exposition. Gold medals and first and second prizes were awarded them in all classes, and for tricycles and quadricycles a special award was given for their use for military purposes. The prizes were awarded, as stated, to motors and voiturettes manufactured by the De Dion-Bouton Co., and also to voiturettes manufactured by other parties but operated by De Dion motors.

# ...OUR... FOREIGN EXCHANGES

## THE BOUDEVILLE IGNITION AND MOTOR COOLING SYSTEMS.

In this system of ignition the current is generated by a magneto machine, the armature of which is stationary, and the field or permanent magnet is attached to the flywheel of the engine. The magnet is in two halves B, and is placed inside the rim of the flywheel A. The armature consists of the two coils C, wound on an iron core. The terminals of the coils are connected to the electrodes E and E[1] in the valve chamber, and the contact points are constantly fanned by the incoming charge, which takes the direction pointed out by the arrows in the figure. The movable electrode E is operated mechanically from the crank-shaft. The cover plate I gives easy access to the electrodes.



The cylinder is provided with spiral flanges L, L, and over these flanges there is a tubular casing. The spiral groove between the flanges is in communication with the crank casing through the passage I[1], and the pumping action of the piston forces the air from the crank casing through this groove, thereby keeping the cylinder walls cool. (From *La Locomotion Automobile.*)

## THE PRECAUTIONS OF A WISE MAN.

A correspondent tells us, says the *Autocar*, that he saw the 50-horse-power racing car, mentioned in a recent issue, when he was in Paris lately, and that an amusing incident is told in connection with it. The machine, as our readers know, is being built at the works of M. Darracq, and when the car was ready for running M. Darracq and his professional driver went out for a run in it, starting off, of course, on the slowest speed. Getting confidence, they changed to the second, and the driver was soon anxious to get on to the third; but the second was quite enough for M. D., who quietly suggested to the driver that in order that he might get the best results out of the car in the matter of speed he (M. D.) would get down, and so lighten the vehicle, thus giving the driver an opportunity of showing what it really could do on the third and fourth speeds. Still, M. Darracq is not alone in his views on the speed question, and there are plenty of persons we wot of in this country to whom the second speed of a 50-horse-power racing car would be quite fast enough to avoid mental perturbation, and, after all, who shall say they are not wise? A man only has one life in this world.

## MOTOR-FARMING.

An alcohol plowing engine was recently exhibited by a motor manufacturing firm in Oberursel, near Frankfort, Germany. The engine is of 20 horse power, and confidence is expressed by competent judges that coal can in some cases be substituted by alcohol, which can be procured everywhere and at a low cost. The alcohol plow is said to have performed its work fully as well as a steam plow operated simultaneously. The problem of using alcohol for power purposes has been solved by the motor factory in evaporating denaturized alcohol of 90 degrees. The construction and operation of the motor is, after this gasification, the same as that of a gas motor. The machine uses about a pint of alcohol an hour for one-horse power. It is claimed that the operating expense is 25 per cent. lower than that of steam power.

## THE WORLD'S RUBBER.

It has been officially ascertained that the approximate total production of rubber annually is 57,500 tons, of which 21,000 tons are taken by the United States and Canada, 21,000 tons by the United Kingdom, and 15,500 tons by the rest of Europe. The producing countries, and the number of tons produced in each, are as follows: Amazon district (Brazil, Peru, Bolivia), 25,000; rest of South America, 3,500; Central America and Mexico, 2,500; Java, Borneo and Eastern Archipelago, 1,000; East and West Africa, 24,000; Madagascar and Mauritius, 1,000; India, Burma and Ceylon, 500; total, 57,500 tons. Of late years the enormous consumption of this article in the manufacture of bicycle tires has created a very great demand. The supply not being able to cope with his demand, the price has steadily increased, and considerable attention is now being paid to the production of rubber all over the world. So great is the demand at present that, although the supply from the Amazon Valley alone has increased from 8,365 tons in 1889 to 25,370 tons in 1899, the approximate price of 2s. 6d. per pound in 1889 had increased to 4s. 6d. per pound in 1899.—*The Mechanical Engineer.*

One after another the potentates of the old world become adepts to the new locomotion. Only recently we brought the information that the Shah of Persia had made extensive purchases of automobiles while on his European trip, to which we may now add that he also engaged a master mechanic (mecanicien en chef) to take charge of his automobile stable, and now the news reaches us that the German Emperor has just received a four-passenger gasoline vehicle, which is described as of the most modern construction, and capable of a speed of 95 km. (60 miles) an hour. The vehicle has been brought to the new palace at Potsdam. The price paid for it is reported to be $6,000.

The Union of German Bicycle Dealers will hold a "bicycle fair" and general automobile exhibition at Leipsic, Germany, October 19-23. According to a prospectus just received, much interest is being taken in this exposition by automobile manufacturers, and practically all the space had been taken at the time the prospectus was issued.

The citizen of Cobourg, France, who some time ago made himself notorious in the motor world by proposing a sort of trap for automobiles, is reported to have been converted to the new locomotion, and to have taken part in an automobile floral parade.

But he does not go now and try his famous machine on himself, says *La Locomotion Automobile.*

## SUCCESSFUL MOTOR CO.

Messrs. Benz & Co., of Mannheim Germany, have declared a dividend of 10 per cent. for the past year, the same as for the previous year.

## CHARGING PLANT FOR ELECTRIC VEHICLES.

The following description of a charging outfit for electric vehicles, manufactured by the Trumbull Mfg. Co. of Warren, Ohio, is sent us by a subscriber of Cleveland, Ohio:

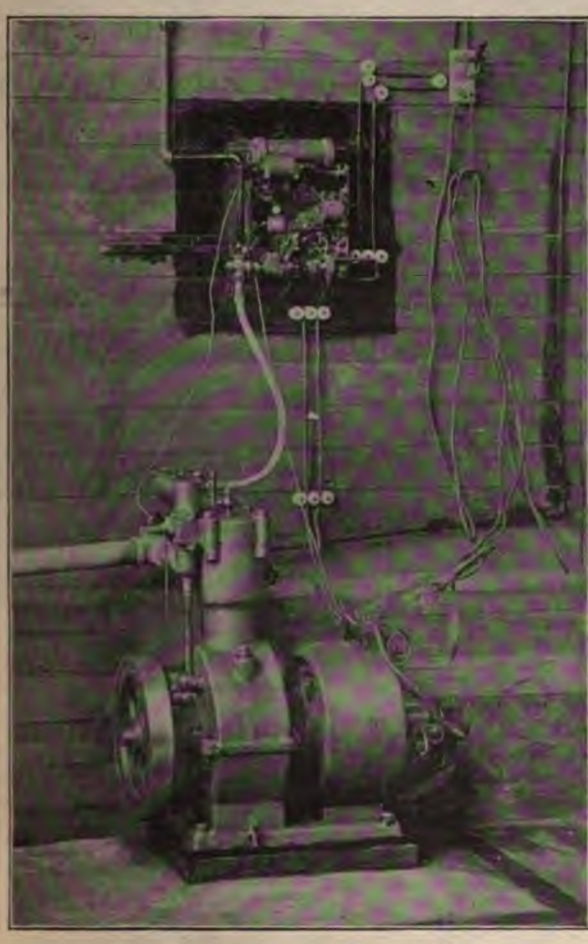
"The accompanying photograph is of a storage battery charging plant for electric vehicles and launches. The plant comprises a high-speed gas or gasoline motor, directly connected to a dynamo, wound for a voltage corresponding with the number of cells used in the carriage.

One of the distinctive features of the machine is that it is automatic, both in starting, when connection is made with the vehicle, and in closing down, when the batteries have become fully charged.

No governor is used on the engine, the speed being determined by the winding of the dynamo, and by the back E. M. F. and resistance of the batteries.

At the start when the cells are nearly exhausted their back E. M. F. is low, and the amperage increases rapidly, until the full load of the engine is reached. As the batteries fill, their back pressure becomes greater, and there follows a consequent drop in amperage. This would mean less power developed by the engine if its speed were controlled by a centrifugal governor, but since the engine is ungoverned, its speed increases, and as a consequence there is a gradual rise of the voltage until the batteries have become fully charged.

No resistance or controlling device is used in connection with the dynamo, and there is no danger of damaging the plates by charging at an excessive rate, as is often done in using city current.



CHARGING PLANT OF THE TRUMBULL MFG. CO.

An electric switch, which automatically opens the circuit when the batteries are fully charged, is constructed so as to also close the fuel valve.

When connection is made with the vehicle, by means of the cable, and the automatic switch is closed, the current from the carriage batteries acts upon the dynamo driving it as a motor, and starting the engine promptly, and at a speed depending somewhat upon the degree to which the batteries have been exhausted, but usually at about one-half the normal running speed.

Under these conditions no alteration of the fuel supply is necessary, and the gas or gasoline valve when once properly set, is allowed to remain in that position, and trouble due to improper mixture is avoided.

The primary "make and break" method of ignition is used, and the current for the igniter is taken from the field coils of the dynamo, which makes the use of batteries other than those of the automobile unnecessary, even in starting.

The dynamo is of the shunt type, and is not compounded. For the sparking current each field winding is tapped at points at such a distance from the terminals as to give the desired voltage.

One of these wires is grounded, and the other led through the spark coil to the insulated pole of the ignition plug. The result of this method of tapping the fields is that a portion of each field is grounded or short-circuited through the spark coil during the time that the points are in contact.

Since the resistance of the spark coil is nearly equal to, or greater than that portion of the field windings between the points where it is tapped, and the duration of the contact at 800 R. P. M. is so brief, the amount of current leaving the field coils is not great, and no evil results are apparent in practice. The tendency is to slightly weaken the field, and cause a corresponding increase in the speed of the machine.

The photograph is of a machine installed for the Baker Motor Vehicle Co., of Cleveland.

The plant has been in constant service for two months, and has fully demonstrated its convenience and practicability.

It has been started hundreds of times, for illustration, and in service, but not once has it been necessary to turn the engine over by hand.

Hard phosphor bronze bearings are used throughout, and are designed so as to be easily renewed. The machine is automatic in lubrication, has no oil cup, and demands very little attention.

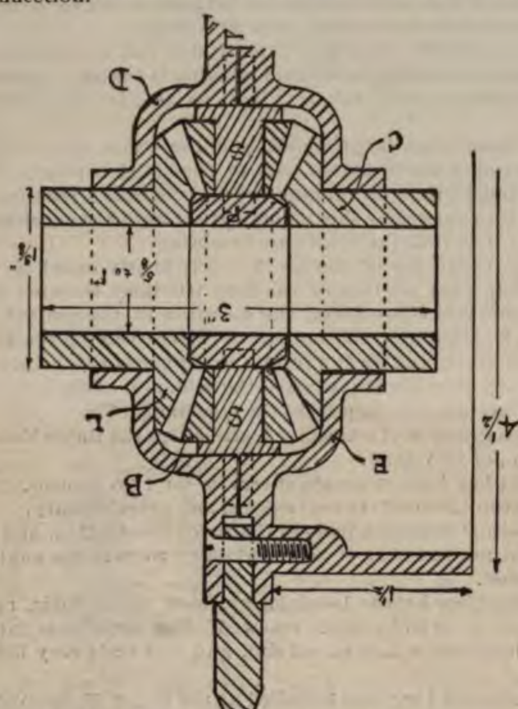
The dynamo of the plant installed at the Baker Motor Vehicle Co. is wound for 30 volts, and has a capacity of 20 amperes. The floor space occupied is 14 inches x 27 inches over all, and the height 25 inches. The weight of the charging set is 325 pounds."

## THE WHITON TIRE.

Lucius E. Whiton of New London, Conn., is the patentee of a rubber tire with embedded metallic segments and fastening devices for connecting these segments with the felloes or spokes. The patent specification describes the method of manufacture of these tires as follows: The sections are supported in the mold by means of screws of the same size and number of threads as those to be afterward used for fastening the tires to the wheel, these screws projecting from the inner side of the mold into the threaded holes in the strips, whereby the strips are held in proper position to leave them embedded at or near the center of the tire. The rubber is then molded in the ordinary manner, and surrounds the strips, and the screws by which these strips are held. After the rubber is hardened, the screws used to hold the steel strips in the mold are turned out. The tire with holes for the screws all in proper place and with its embedded strips may then be stretched over the felloe.

## DIFFERENTIALS AND DRIVE CHAIN.

The Boston Gear Works, of Boston, has issued a catalogue of differential gears, chains and other motor vehicle parts. We notice specially a chain for heavy motor vehicles, an article for which there is a growing demand, as this class of vehicle is receiving more and more attention in the United States. The pitch of the chain is 2¼ inches, and it is intended for sprocket wheels of 1⅞-inch width of face. The rivets and sleeves of these chains are hardened, and the side links are made of a special grade of steel. The spaces between the sleeves of these chains are considerably larger than they were in the old style of chain, and they admit, therefore, of sprocket teeth of considerable thickness. It is claimed that this construction is especially suited to sprocket pinions of a small number of teeth. A hardened bolt and nut are furnished with each chain for connection.



The differential gear, herewith illustrated, is intended for light vehicles, weighing not over 300 pounds without load. It is provided with a sprocket wheel and a brake drum. The outside diameter of the sprocket is 6⅛ inches and it has 18 teeth of 1-inch pitch. The total weight is eight pounds. Instead of a sprocket wheel, a bevel or spur gear may be provided to suit the demands of the purchaser. The standard differentials of the Boston Gear Works have three bevel pinions, but they may also be made with six pinions if so desired.

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We have received from the W. F. and John Barnes Co., of Rockford, Ill., an elegantly gotten up catalogue of their metal-working machinery. The catalogue is a very fine specimen of modern advertising literature, many of the cuts being in colors to show parts finished and not finished. It contains descriptions of the well-known lathes and drill presses of the firm, and also a number of novelties in this line, among which may be mentioned some electrically-driven drills, in which the electric motor is either belted or geared to the countershaft of the press. Many new shops are now equipped with electric transmission throughout, and there is, therefore, a demand for machine tools having motors directly attached. A cone pulley with an internal back gear is also shown, and the catalogue winds up with a description of small tools and lathe attachments. The screw cutting foot lathes of the Barnes Co. have long been favorites in the workshop of the experimenter and the amateur.

## A NOTABLE DEMONSTRATION OF SERVICEABILITY.

One of the best tests of the durability and practical utility of the automobile was recently made in California by F. H. Holmes, a fruit grower of San Jose, who is the owner of one of the Stanley Mfg. Co.'s superb steam carriages, made at Lawrence, Mass.

Mr. Holmes, after taking several shorter journeys through the country adjacent to his home and determining to his complete satisfaction the substantial character of his carriage, set out on a trip through the famous Yosemite Valley, into which several owners of light steam carriages had ventured with far from satisfactory results. Mr. Holmes, however, accomplished the entire trip of almost 2,000 miles without a breakdown, going in and coming back on his own wheels and with his own

power. The roads in many places are exceedingly sandy or littered with stones, which are a severe strain on the tires, as well as on the whole running gear of the machine.

The illustration shown, taken under the famous Bridal Veil Fall, will give some idea of the heavy roads encountered. Notwithstanding this, it was nothing unusual for the tourists to make 150 to 175 miles in one day.

During the year past, the period of time this carriage has been in service, it has made over 6,000 miles, and the makers report that the only part replaced by them was a new burner, which was substituted for the old-style burner in use at the time it was sold.

In justice to the manufacturers of this carriage it should be stated that they are in no way connected with the makers of the light steam carriages who have been receiving the credit for the above performance in the public and the untechnical press.

## NEW LOCKE STEAM SPECIALTIES.

Among the steam specialty makers who have grasped the opportunities for trade offered by the automobile is the Locke Regulator Co. of Salem, Mass. They have during the past six months added a number of improvements to their line and have begun the manufacture of engines and boilers for steam carriages.

The engine which they are offering has gun metal main bearings, double, V-shaped crossheads, crosshead pump, connecting rods from steel castings, and link motion reversing gear. It weighs 45 pounds, has a cylinder 2½ and a stroke 3½ and develops 4 h. p.

The boiler, 14 x 13 inches, is made from solid drawn copper tube with steel heads firmly riveted to it, and is wound with three layers of piano wire. There are 300 half-inch tubes and the total weight is 100 pounds, and the cold water pressure test 800 pounds. Besides this copper boiler, they are also making a steel boiler, 16 x 18 inches, having 350 tubes and weighing 140 pounds.

A burner of special design, which is one of the most important additions to their list, has punched instead of drilled holes, so small as to prevent back fire. With this burner they advocate an air pressure of 35 to 40 pounds to keep up steam and for this purpose are supplying 60-pound gages in place of the lower ones formerly used. As a preventive of the leaks which have been such frequent causes of fire on steam carriages, they have introduced a silver solder, producing a joint nearly as strong as steel and said to be proof against the vibration of the road.

Their new emergency hand force pump for the boiler can be run with the same check valves that are now used on pumps, and is so attached to the side of the carriage that the end of the handle comes on a level with the floor of the carriage.

To prevent the burning of the boiler they have devised a Patent Safety Shut-off Glass Gage for the outside of the carriage body. This gage will shut off automatically when the glass breaks, and the valves are opened after inserting a new glass by the little handle outside being pushed back.

## IGNITION DYNAMO OF THE CARLISLE & FINCH CO.

The Carlisle & Finch Company, Cincinnati, Ohio, are manufacturing a small shunt spark generator, of which they furnish us the following details:

This machine is so designed to give satisfactory service at any speed between 700 revolutions per minute and 2,400 revolutions per minute. The shunt winding permits it to "pick up" promptly, and the builders have had one running successfully upon a four-cylinder gasoline engine, when the engine was making 700 revolutions per minute, which would give 1,400 sparks per minute.

The machine has a simple type of radial brush-holder, using carbon brushes, which do not wear out the commutator. The field magnet is made of steel, having a high magnetic permeability, and is thoroughly annealed to get the best results. The armature core is made of toothed sheet iron punchings, and is drum wound, as the best types of larger machines. The wearing parts are of ample area, so that they possess good lasting qualities, and they are so designed as to be readily replaced and at small cost, should it be necessary to do so. The dynamo is securely fastened to a base of cast iron, and there are no wooden parts about the machine.

The dimensions of the machine are as follows: Height, 6¼ inches, length of shaft 10 inches, base 5¼ x 7 inches; the weight of the machine, including the spark coil, is 19 pounds. Each dynamo and spark coil are given several coats of waterproof paint, and are practically waterproof. The output is from two to three amperes at 10 to 20 volts, according to speed.

## PARIS JURY AWARDS MEDALS TO WELL-KNOWN AMERICAN STEAM SPECIALTY COMPANY.

The Ashton Valve Co., Boston, Mass., have received word that the Jury of Awards at the Paris Exposition has awarded them three medals, one silver and two bronze, on their exhibit of pop safety valves and gages, the silver medal being the highest award obtainable in this class of goods.

We reproduce a picture of their exhibit as a representative showing of an important American specialty by well-known makers of meritorious goods.

# MOTOR VEHICLE PATENTS ∴ ∴ OF THE WORLD ∴ ∴

## UNITED STATES PATENTS.

657,516—Motor Vehicle.—Clyde J. Coleman, of Chicago, Ills. September 11, 1900. Application filed October 27, 1899.

The patent refers to a controlling mechanism of an electrically-propelled vehicle. The same lever operates an electric controller and a mechanical speed-changing device.

657,643—Lubricator for Engine Cylinders.—George A. Burwell, of Toledo, Ohio. September 11, 1900. Application filed June 15, 1899.

The invention comprises a force feed lubricator for explosive or other engines. In the drawings the lubricator is shown as applied to an explosive engine. The cylinder has two openings, f and g, extending across the water space, and through the outer jacket. The pressure opening f is preferably so located that the exhaust port will be partially opened before the pressure port is uncovered. The lower or outlet opening g is so located as to be about opposite the piston rings e, e, when the pressure port is uncovered.

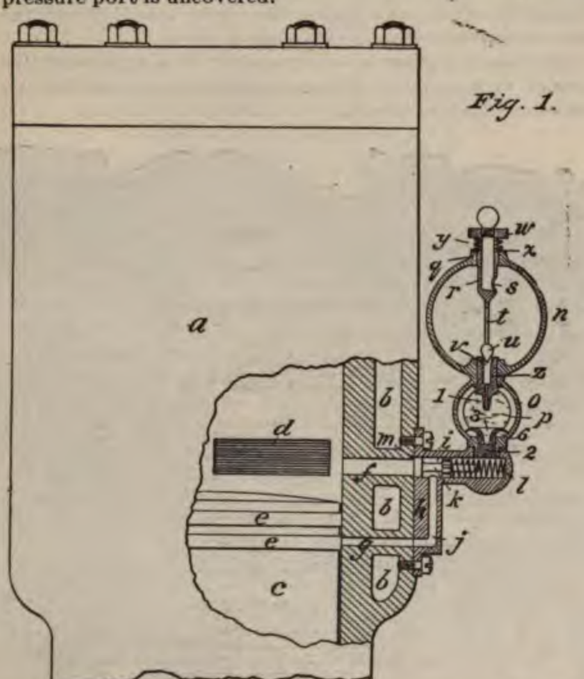


Fig. 1.

In the chamber l of the base h of the lubricator there is a rod k with a piston and a guide. The guide, as seen from the illustration, has a number of notches or grooves across its face to permit the continuous passage of oil to the space between the piston and guide. When the opening f is uncovered by the piston after a power stroke, the pressure in the cylinder will force the small piston to a position past the passage j, and thus admit the cylinder pressure to this passage. The pressure will force the lubricant, which has previously collected in the passage, through the opening g, around the rings of the piston, the force of the pressure being claimed to spray the lubricant thoroughly, and thus provide a sure and thorough lubrication with no waste of material.

657,576—Gas Engine.—Hinsdale Smith, of Springfield, Mass. September 11, 1900. Application filed May 11, 1899.

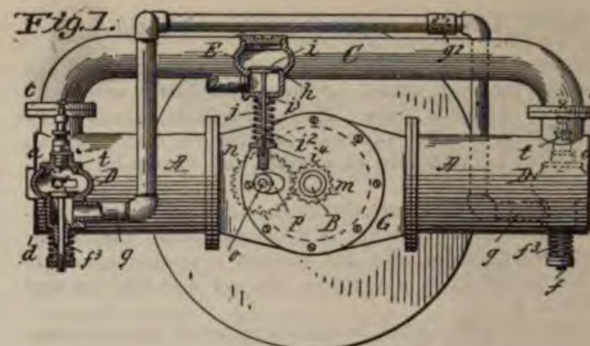
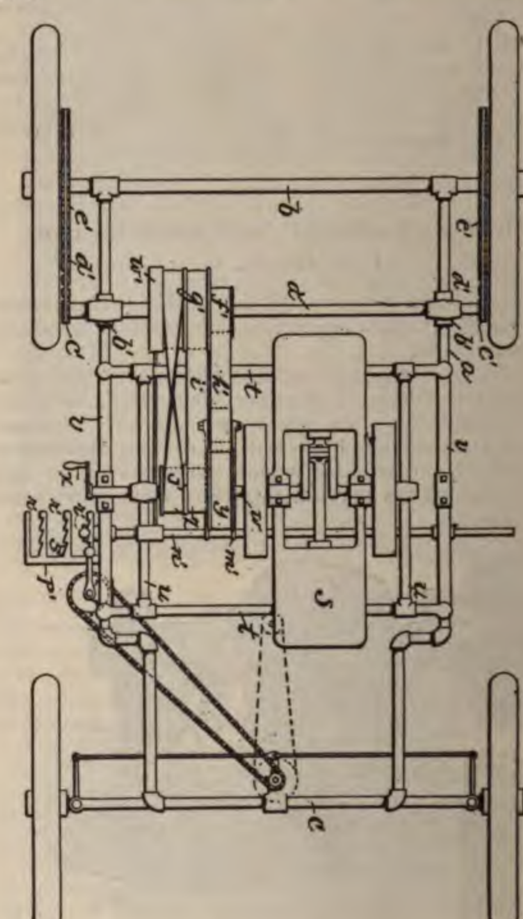


Fig. 1.

This is a double-cylinder engine, in which the cylinders are disposed oppositely, but are axially coinciding. The two pistons work on a double-cranked shaft, and the explosions in the two cylinders occur simultaneously. The ends of the two cylinders are connected by a common bow-shaped conduit C, n which there is an exhaust valve i. The conduit forms the compression space of the cylinders, and there is very little clearance in the cylinder when the pistons are in the most outward position. The burnt gases are, therefore, almost entirely expelled from the cylinder by the exhaust stroke, only the conduit C remaining filled with these gases. The new charge enters by the intake valves D, and does, therefore, not mingle with any of the burnt gases, to accomplish which is the object of the invention.

657,650—Automobile Vehicle.—Leonard Huntress Dyer, of Washington, D. C. September 11, 1900. Application filed June 8, 1898.



The vehicle frame is shown provided with a double cylinder engine S, the cylinders being disposed oppositely, with the pistons working on a single crank. The engine is supported on the frame, or reach, of the vehicle by semi-elliptic springs. Three pulleys are fast on the engine shaft, and three corresponding pulleys fast on a countershaft $a^1$. Each set of corresponding pulleys is connected by a loose, endless belt. Two of the belts correspond to forward motion at different speeds, and the third to a reverse motion. By means of a single jockey-pulley, operated by a hand lever, any of these belts may be tightened, and thus the speed of the vehicle be varied or reversed.

657,662—Controlling Means for Explosive Engines.—Frederick A. LaRoche, of New York, N. Y. September 11, 1900. Application filed March 14, 1900.

A triple cylinder engine is directly connected to a dynamo, which is electrically connected to a storage battery through the intermediary of a controller. A method of controller connections for starting the engine and dynamo by the power of the battery is described. The time of ignition is automatically varied by a ball governer, which varies the position of the contact brush, establishing the circuit of the induction coil primary winding.

657,684—Cooling Apparatus for Motor Carriages.—Ansbert Emil Vorreiter, of Aix-la-Chapelle, Germany. September 11, 1900. Application filed April 16, 1900.

The invention relates to a device for lowering the temperature of the cooling water of explosive motors, or for condensing purposes in steam vehicles. The cooling device serves also as frame of the vehicle, and consists of four members, viz: The rear transverse member of the frame, or reservoir, the two longitudinal members and the front transverse member. The front transverse member is provided with flanges, the same as air-cooled cylinders, to increase the radiating surface, and for the same purpose, the longitudinal members of the frame are provided with internal tubes, concentric with the main tubes, which are open at both ends, and at the front run out into funnel-shaped endings, which facilitate the circulation of the air. A pump is used to circulate the water in the pipes and reservoir.

657,760—Electric Igniter for Explosive Engines.—Isaac H. Davis, of Boston, Mass. September 11, 1900. Application filed November 18, 1899.

Referring to the Fig., 18 is an igniter shaft or secondary shaft, revolved once for every two revolutions of the engine (for an Otto—or four-cycle engine); 19 is a disc or wheel of insulating material secured to the shaft 18, and having a conductive ring 20, with which the brush 16 is normally in continuous contact; 21 is an isolated section of the conductive material, embedded in the periphery of disc 19, and adapted to make contact with the brush 17 once in each revolution of this disc; 22 is a block of conductive material electrically connected with the conductive ring 20 through a screw 23. The blocks 21 and 22 are normally connected electrically by means of a U-shaped conductive piece 24, forming part of a speed-governor, the construction and operation being such that the primary circuit is made and broken between the brush 17 and the contact 21 once for every revolution of the shaft 18, and a spark is thereby produced between the igniting-points in the cylinder. The brushes 16, 17 are mounted upon a normally-stationary but adjustable disc 25, of insulating material, which is adapted to have a rotary movement concentrically with the shaft 18. Assuming the rotation of the shaft 18 to be clockwise in the direction of the arrow, it is evident that a movement of the brush-carrying disc 25 in the direction of rotation of this shaft will time the explosion later in the receding stroke of the engine-piston, while a contrary movement will time the explosion earlier in the stroke. As the disc 25 approaches the limit of its clockwise movement, the igniting circuit may be broken entirely, by causing an extension of brush 16 to abut against the fixed cam stud 26, which lifts the contact shoe clear off the cylinder or disc 20.

The governor is constituted as follows: The U-shaped metal part 24 is mounted upon the face of an insulating block 31, which is attached to the end of a spring arm 32, carried by a pivot stud 33. The latter is journaled in the face of the disc 19, and is also passed through a transverse hole in the end of the shaft 18, so as to afford a means for attaching the disc 19 to the shaft 18. It will be observed that the tension of spring 32 will be exerted through pin-stud 33, in a direction to hold the pin 36 inward to its seat. The centrifugal force exerted radially on the free ends of the spring arm 32, carrying the U-shaped piece 24, has a component which tends to rotate the end of the arm around the stud 33 as a center, and when a certain speed, determined by the tension of the spring arm 32, has been attained, the U-shaped piece will be thrown away from the contact blocks 21, 22, and the igniting circuit will accordingly be broken, and the explosion in the cylinder will cease until the speed has been reduced.

657,738—Carbureter for Explosive Engines.—Henry L. Jessen, of Watsonville, Cal. September 11, 1900. Application filed November 15, 1899.

The carbureter consists of an outer casing A, to which the exhaust gases of the engine are led by the pipe 2, and from which they are discharged through a pipe 3, and an inner, horizontally disposed, revoluble cylinder 4, supported by hollow shafts, and turning in suitable bearings. One of these shafts, 5, serves as an inlet for the hydrocarbon liquid. Through the other hollow shaft, 10, and the connecting pipe, 9, the gaseous mixture, formed in the carbureter, is drawn to the cylinder by the sucking action of the forward moving piston.

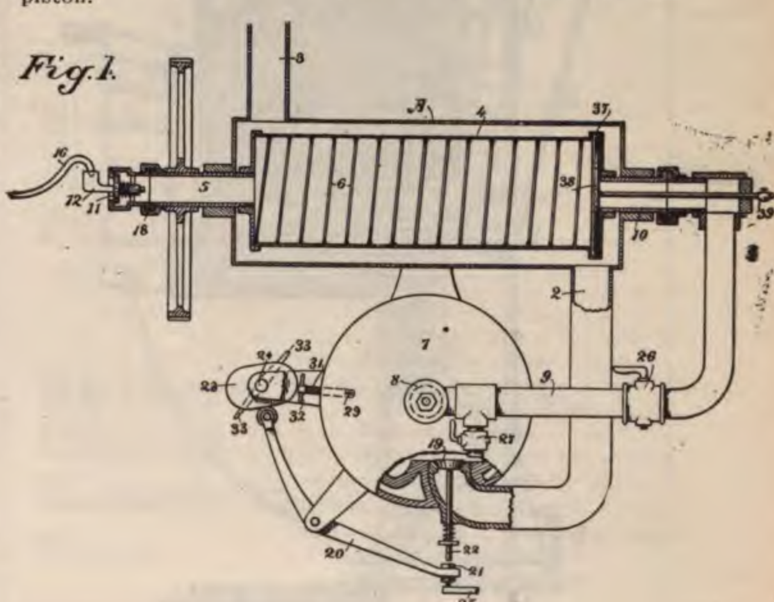


Fig. 1.


Fig. 4

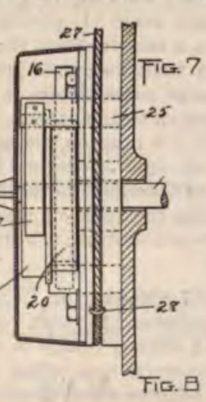


Fig. 7 Fig. 8

A certain amount of air is admitted into the generator through the outer end of the hollow shaft 5 (valve 11), and the hydrocarbon liquid is admitted at the same point by a pipe 12, one end of which opens into the hollow shaft 5, and the other is connected with an open topped tank (not shown). The upward curve 16 of the pipe, connecting pipe 12 with the constant level tank, is a little above the level of the liquid in this tank, and this prevents flow of the liquid when the engine is not in operation.

The suction of the piston will draw air through the valve controlled passage 11; but this passage is purposely made small, and there will, therefore, be an air pressure on the liquid in the open constant level tank, which will force a little of this liquid through the connection pipe into the generator.

The generator 4 is rotated slowly by means of any suitable connection to the engine shaft. The liquid passes along spirally disposed interior flanges, and is thus exposed to the action of the hot exhaust from the engine, which vaporizes it.

The connection between the hollow shaft 10 and the suction pipe 9 may be made by means of a suitably packed joint 18.

657,711—Motor Vehicle.—Francis E. Stanley and Freelan O. Stanley, of Newton, Mass. September 11, 1900. Application filed October 16, 1899.

This is a patent relating to the steam and smoke discharge arrangement of the familiar locomobile. Above the boiler, and also enclosed within the body, is a hood 90, which serves to convey to the rear, and away from proximity to the seat, the products of combustion or gases passing through the boiler from the burner. This hood has two flues—a flue 91, extending upward, preferably at a distance from the seat, and a flue 92, extending downward. When the apparatus is at rest, and the flame of the burner reduced, the flue 91 affords a natural upward draft that will insure the maintenance of the reduced flame. When the apparatus is in motion, the exhaust-steam is directed by the exhaust-pipe 132 downward through the flue 92 into the roadway. This disposition of the exhaust gases, smoke, steam, oil, etc., prevents injury to the clothing and the discomfort of the passengers, resulting when these matters are projected upward, and in many instances so disposes of the smoke and steam that they are not perceptible. This arises in part from the fact that the air can pass downward from the flue 91 into the flue 92 (induced by the injector action), and this condenses the steam and cools the gases, while more solid matters are projected so forcibly on to the road-bed that they remain there.

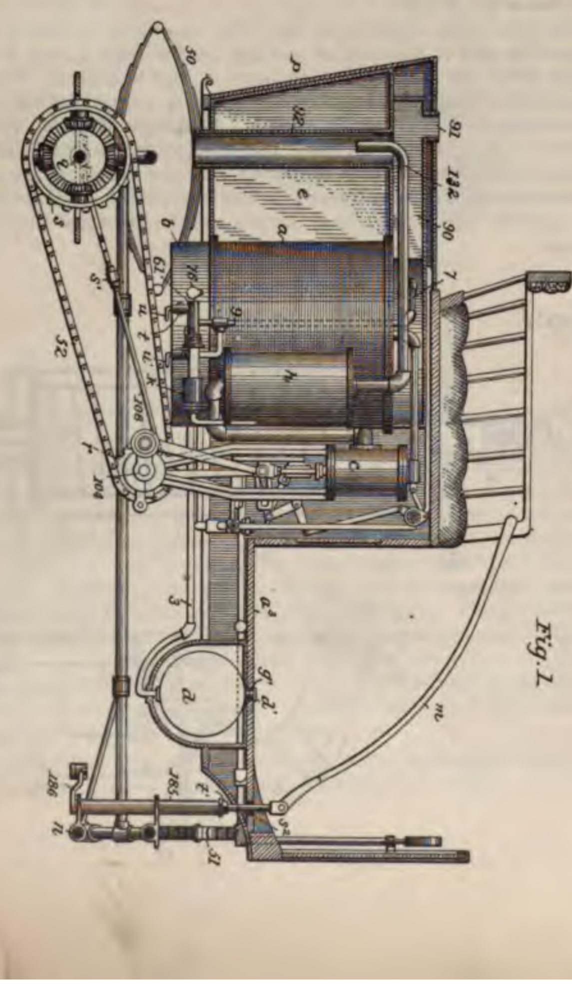


Fig. 1.

657,771—Transmission Device for Motor-Cars.—Fritz Henriod-Schweizer, of Marvin, Switzerland. September 11, 1900. Application filed April 12, 1900.

This is a speed-changing gear, giving four forward speeds and one reverse, all these speeds being obtained by a single operating lever.

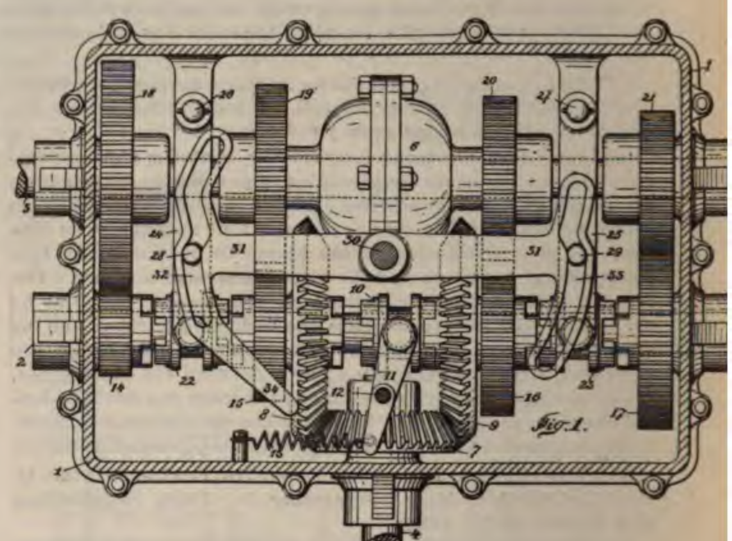


Fig. 1.

The motor shaft 4 carries a bevel gear 7, engaging with other bevel pinions 8 and 9, mounted loosely upon shaft 2. By means of a positive clutch 10 either of these pinions 8, 9 may be clutched to shaft 2, and the latter thus be given either a right or left-hand rotation. Shaft 2 also carries four spur gears, of varying sizes, engaging with corresponding gears fast on the differential shaft 3. The four spur gears on shaft 2 are loose, but any one of these gears may be made fast to the shaft by one or the other of two positive clutches 28, 29. The shipper levers 24, 25 of these clutches are provided with pins 28, 29, working in grooves 32, 33, at the ends of a double-armed lever 31, pivoted on the shaft 30. The grooves have such a relative form that only one of the gears can be engaged at a time, and that gears corresponding to successive speeds engage successively as the lever is moved from one extreme position to the other.

34 is a nose on the extremity of the lever 31, and intended to act upon the lever 11, operating clutch 10 in such a manner as to disengage bevel pinion 9, and engage bevel pinion 8, thus giving the vehicle a reverse motion. Pinion 9, which gives the forward motion, is normally held in engagement by the spring 13.

657,899—Motor Vehicle.—Clyde J. Coleman, of Chicago, Ill. September 11, 1900. Application filed December 8, 1899.

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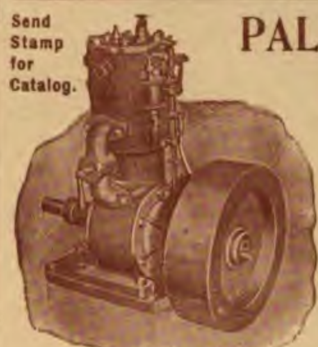

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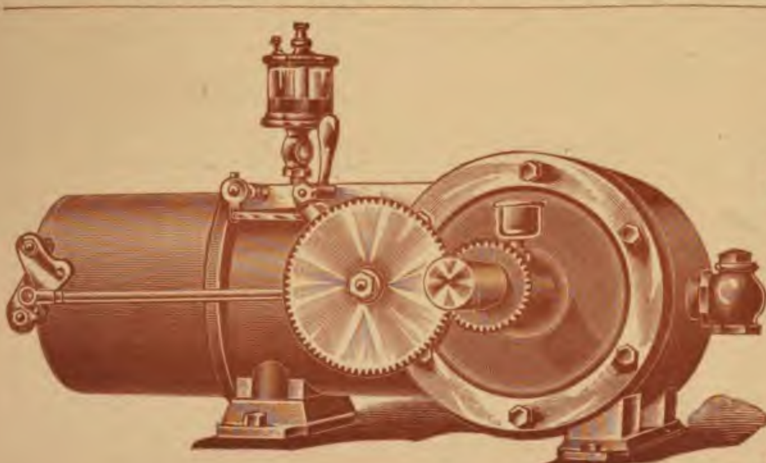

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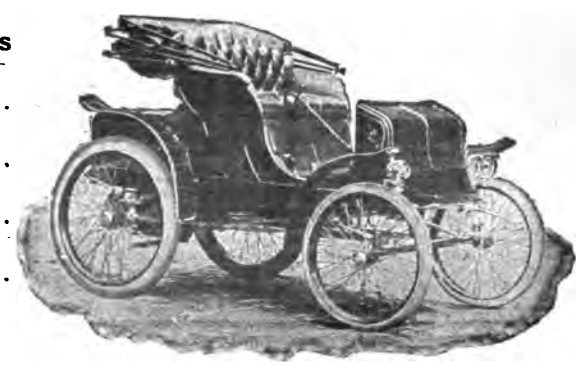

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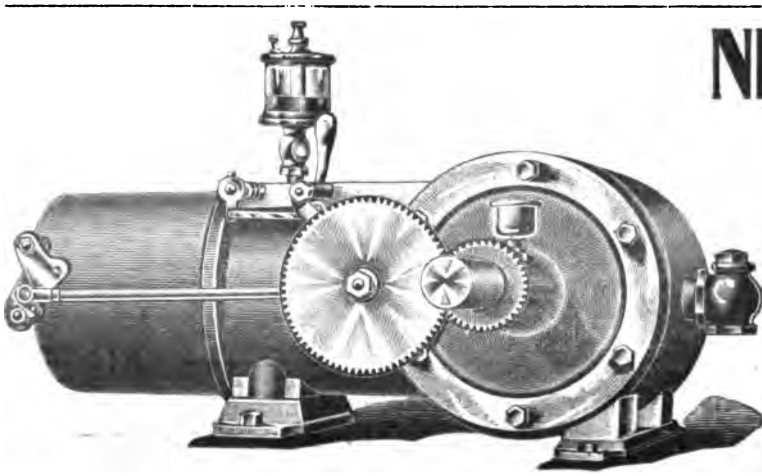

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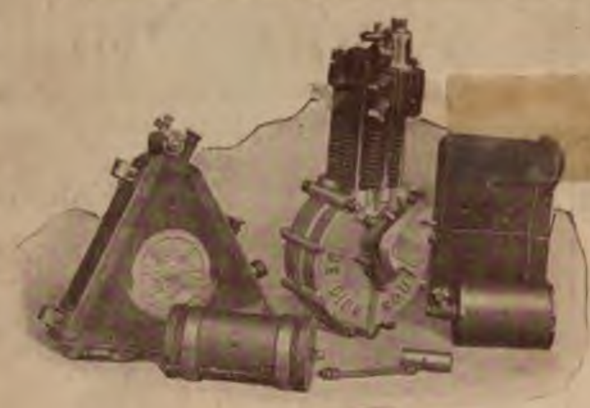

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